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☞ An asterisk (*) denotes an illustrated article

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WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS*, or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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TO THE MEMBERS OF THE AMERICAN GAS-LIGHT ASSOCIATION.

OFFICE OF THE AMERICAN GAS-LIGHT ASSOCIATION,

117 BROADWAY, NEW YORK, Aug. 31, 1876.

The Fourth Annual Meeting of the AMERICAN GAS-LIGHT ASSOCIATION will be held in the city of New York on the third Wednesday of October (the 18th) 1876.

CHAS. NETTLETON, SECY.

For the information of members of the Association, it may be said that several papers have been promised, and the following subjects will be discussed, viz.:

Retort Settings.
Tar as Fuel under Retorts.
Breeze as Fuel under Boilers.
Gas for other than Illuminating Purposes.
Testing Meters.
Purification.

It is hoped, from partial promises that have been made, that papers will also be presented upon "Residual Products," and upon "Distribution and Service."

If any member of the Association has facts and figures upon any of these topics, he is most respectfully urged to bring them with him, or, if unable to attend, to send them to the Secretary, or other satisfactory person, that they may be presented in connection with the discussion to which they relate.

Papers or commnications are respectfully invited from members of the Association, upon any of the topics mentioned in the circular from this office, published in the AMERICAN GAS-LIGHT JOURNAL, of June 2d, 1876. It is the earnest desire of the officers of the Association to make this meeting one that shall be of mutual benefit to all who attend, and to those also who are unable to be present. In order to make the society of the greatest practical benefit to all concerned, all those who are engaged in the manufacture of gas must take a positive and active interest in the meetings; and while it is understood that many are prevented from attending, by the great distance they have to travel, and the consequent necessity of a considerable absence from duties which require constant attention, still many such may contribute largely to the success of the Association, by sending statements of actual experience upon some of the various points to be discussed. In order to make it a true Gas Managers Association, the gas managers of the country must each and every one be willing and ready to contribute whatever he can to the general result.

The great advantages derived by similar Associations in Europe may be fully equalled by us, if we each, individually, take our stand as gas managers should, and work together to carry forward the objects of the Association as set forth in its constitution.

It is suggested that those intending to visit the Centennial Exhibition arrange their visit for the same time as the meeting—as, if it is deemed advisable, arrangements can be made for the members of the society to go there together after the meeting. CHAS. NETTLETON, Secy.

THE EFFECT OF TEMPERATURE IN DEPOSITING NAPHTHALINE.

As an indication of one cause for the deposition of naphthaline in service pipes, we give the following facts which are authentic:

A brewery in this city had for some time periodical trouble in getting the supply of gas that they desired. The gas fitter was called in and "blew out" the service and pipes, and the trouble disappeared for a while; but, in the course of a short time, the trouble returned. Similar treatment gave like results. Finally, after repeating the operation for a number of times, the gas fitter concluded that there must be a settlement in the service, or the service must be too small, or something else was radically wrong in the means of supplying the building. Application was made to the Gas Co., who promptly had the service uncovered and everything was found all right. No settlement, plenty of fall, and ample size. The cause for the trouble was then sought in earnest, when it was found that the pipe in the building was run under the floor of a large room used as an *ice house*; and upon examination it was found that the part of the pipe under the ice house was choked with naphthaline. The remedy was apparent, viz—To move the pipe so that it would not be subject to the influence of the *refrigerator*. The temperature at which the volatile naphthaline crystalizes was obtained by the proximity of the iee. As no other case of the appearance of naphthaline had occurred with the gas company for a long time, they were convinced that they had not an excess of this valuable illuminant in their gas over and above what it could carry at a proper temperature. The crystals of naphthaline easily dissolve in steam, but a reduction of temperature recrystalizes it and deposits it. When the gas contains a large amount of the rich hydrocarbons it takes up the naphthaline and carries it—hence, an addition of 10 or 15 per cent. of Ritchie Mineral, or rich cannel, to the charges, for a few days, will remove this excess (when it shows itself) from pipes and connections.

In case the location of the trouble does not permit of waiting, steam introduced at the point where the trouble exists, will give immediate relief at that point, and the enricher will cure the trouble generally—even to the burners in the street lamps.

WORKING RESULTS

Obtained by the German Continental Gas-Light Company, of Dessau, for Twenty Years—1856 to 1876.

Year.	No. of gas-works in operation.	Gas produced. Total in cubic feet.	Gas produced. Increase over year preceding.	Unaccounted-for gas. %	Number of burners. At end of year.	Number of burners. Increase.	Consumption per single burner. Street Lamps cu. ft.	Consumption per single burner. Private. cu. ft.	Length of mains. Prussian feet	Coal. Tons carbonized.	Coal. Price per ton at works in dollars and cents. Gold	Average selling price per thousand cubic feet, in dols. & cents. Street Gas.	Average selling price per thousand cubic feet, in dols. & cents. Private Gas.	Dividends %
1856	8	24,913,886	——	15.80	10,678	——	——	——	——	——	—	——	——	5
1857	10	64,470,753	39,556,867	9.68	26,097	15,419	——	——	——	——	—	——	——	6
1858	13	125,144,751	60,673,998	10.59	42,022	15,925	8902	2510	747567	13889	5.84	1.23	1.92	6
1859	—	143,630,880	18,486,129	6.48	48,177	6,155	8023	2388	758419	14791	5.51	1.22	1.87	6
1860	—	159,077,359	15,446,479	5.50	54,459	6,282	7984	2414	777736	15464	4.93	1.15	1.81	6⅔
1861	—	172,639,772	13,562,413	6.00	60,391	5,932	8277	2332	803107	17368	4.55	1.13	1.77	7¼
1862	—	183,610,396	10,970,624	5.45	66,451	6,060	8136	2267	821066	18313	4.18	1.16	1.78	8⅓
1863	—	195,413,578	11,803,182	4.98	72,037	5,586	8674	2209	857888	19420	4.09	1.21	1.78	9⅓
1864	—	216,427,870	21,014,292	6.06	79,690	7,653	9079	2246	929765	21829	4.62	1.15	1.71	9¾
1865	14	251,809,057	35,381,187	6.85	87,771	8,081	8968	2383	935290	25418	3.96	1.13	1.66	11
1866	—	274,999,846	23,190 789	5.47	94,881	7,110	9174	2420	1042996	27853	3.96	1.09	1.56	11
1867	—	297,616,784	22,616,938	5.23	102,960	8,079	8904	2458	1105654	30078	3.91	1.05	1.48	11
1868	—	324,852,146	27,235,362	5.61	109,339	6,379	9079	2496	1152714	32377	3.79	1.08	1.43	11⅔
1869	—	345,851,716	20,999.570	5.48	116.279	6,940	9223	2538	1215286	34475	3.87	1.04	1.36	11⅔
1870	—	371,157,124	25,305,408	5.46	123,914	7,635	9296	2544	1246605	40128	4.13	0.98	1.33	11⅔
1871	15	417,542.234	46,385,110	5.80	132,473	8,559	9288	2730	1276288	45061	4.58	1.02	1.34	12½
1872	—	479,098,136	61,555,902	5.56	143,171	10,698	9997	2936	1317937	52787	5.04	1.03	1.33	14⅓
1873	18	544,384,711	65,286,575	5.95	157,560	14.389	10158	2993	1407459	59092	5.68	1.01	1.34	13½
1874	—	604,586,741	60,202,030	6.65	169,260	11,700	10446	3116	1496556	64746	5.75	1.01	1.35	13
1875	—	653,905,637	49,318,886	6.78	181,781	12,521	10704	3133	1614541	68958	4.87	1.01	1.32	13⅓

The German Continental Gas-Light Company of Dessau.

The Continental Gas-Light Company, of Dessau, was organized on March 12th, 1855, with a capital paid up of $721,282. The object of the organization was to acquire, either by lease or purchase, a number of gas works, and to operate them under the administration of one organization, thus securing the advantages of economy, working as far as possible under the same system in all the works, and being able to compare the workings of one station with that of all the others.

The company commenced with eight works in operation, with capital as stated above. In 1875 they were operating 18 works, and two gas-meter manufactories, with a capital of $2,934,848. The Table which we give above, translated and prepared by T. H. Muller, is from "Dingler's Journal fur Gasbeleuchtung," and, we doubt not, will be deemed of value by all our readers who are interested in the manufacture of gas. Each man can, from the figures here given, figure out whatever points he pleases, so far as they are to be derived from the facts given.

The average amount of fuel consumed in 1875 was 21·86 lbs. of coke per 100 lbs. of coal carbonized. The retorts gave an average production of four and a-half millions cubic feet before they were worn out and removed.

The highest average production per retort, per day, was 8,314 cubic feet.

The average production of tar was 5·67 lbs. per 100 lbs. of coal.

One hundred and ten lbs, of coal produced, on an average, 467·85 cubic feet of 15·9 candle-gas.

The following is a list of the 18 works operated by this Company:

1	Frankfort-on-the-Oder	Dec.	1855
2	Mulheim-on- the-Ruhr	Jan.	1856
3	Potsdam, Neuendorf — 2 works	Oct. / Nov.	1856 / 1865
4	Dessau	Oct.	1856
5	Luckenwald	"	1856
6	Gladback, Rheydt — 2 works	" / Nov.	1856 / '1865
7	Hagen	Dec.	1856
8	Warschaw	Dec.	1856
9	Erfurt	Oct.	1857
10	Krakau	Dec.	1857
11	Nordhausen	May	1858
12	Lemberg*	May	1858
13	Gotha, leased	July	1858
13	" bought	"	1872
14	Ruhrort	"	1873
15	Eupen	"	1873
16	Herbesthal	"	1873

* Changed from wood to coal in 1870.

There are a few points to which we would call attention:

1st. The steady increase in the amount produced. From 1858 to 1865 the company was operating 13 works, the increase in eight years was from 125 millions to 216 millions, nearly double, although the increase for each year varied from 10 to 21 millions.

2d. The reduction in the item of "unaccounted-for-gas." It will be seen that when the works were first purchased this item was nearly 16 per cent., and that under the subsequent management this was kept down to about six per cent., notwithstanding the large increase in length of street mains from 747.000 feet to 1,615,000 feet.

3d. The economy of conducting these operations under one head, instead of dividing them up, is to be seen from the dividend column. The first year only 5 per cent. was paid, but doubtless the first few years consumed a large sum in getting the works into a good working condition; but as the number of works increased the price of gas was reduced, and the dividends constantly increased.

A comparison of the price of coal with the dividends would show a constant improvement in the management and manufacturs—for, with coal at $3·79 in 1868, the dividend was 11 per cent., and with coal at $5.75 in 1874, it was 13 per cent.

Here is food for reflection for those who argue that "opposition," or division of the manufacture, benefits the consumer. This is a delusion and a snare. The dear people are not the parties who derive the benefit from a multiplication of works, administrations, officers, and sets of men employed.

This is proved by the table above, as well as by the events transpiring in London, Paris, and other leage cities where the business is managed as much with a view to the *true* interest of the consumer as it is anywhere, and where consolidation and not multiplication of companies is the order of the day. If the same amount of money, labor and energy were expended in developing, improving, and increasing the business of the companies already established, as has been spent in getting up new companies "for the benefit of consumers," the dear people would be much better and more cheaply served, while, perhaps, the amount of money legitimately made by those so anxious to serve the public would doubtless be increased at the same time. We trust that the time may some day come when we shall be able to publish some collated statistics of our own gas manufactories, from which valuable deductions can be drawn, that may be the means of enabling our gas-makers to work more understandingly, and with more concert of action: certainly, there are great advantages to be derived from a tabulated statement like the above, although very few points are given. The table could be very largely extended in many of its details, and would then be of correspondingly increased value.

North British Association of Gas Managers.

The fifteenth Annual General Meeting of the Members of this Association was held on on the 14th of July, in the Royal Scottish Society of Arts Hall, 117 George Street, Edinburgh. Mr. Samuel Stewart, President of the Association, occupied the chair.

The President delivered the following—

INAUGURAL ADDRESS.

Gentlemen: You have done me the honor to elect me to the office of president, it becomes my duty, in introducing the business before us, to make a few remarks, and this I shall do very briefly, having in view the papers that are to be read, and which I fear, from their importance, we shall have only too little time to discuss.

This is a very fitting opportunity to glance over the present position of this Association. Many of you know its past history, but I may simply say that fifteen years ago—viz., in 1862, Mr. Loudon, of Leven; Mr. Myers, of Broughty Ferry; Mr. Proctor, of Forfar; and Mr. Mackenzie, then of Cupar, in the month of January, 1862, met accidentally in Cupar, and recognizing the mutual advantages of association, agreed to ask the co-operation of other gas managers for this purpose, which resulted in a meeting of

twenty managers in Cupar on the 30th of July, 1862, when the Association of Gas Managers for the four counties of Fife, Kinross, Perth, and Forfar, was formed,

A similar Association, called the "Scottish Association of Gas Managers," was, in September of the same year, formed in Edinburgh, with a membership of twenty-two managers. These two Associations united on September 14, 1865, forming the present "North British Association," with a united membership of fifty-four, and it is not too much to say that the gentlemen who proposed these Associations, and carried out their union, could hardly have imagined that the united Association would have risen to the importance it has, or that it would have given birth to so many other Associations in all parts of the country, on the Continent, and in America, having the same objects in view—namely, the advancement of the science of gas-manufacture; and it must be very gratifying indeed to these gentlemen to see the position this Association now holds.

I am not aware that there have ever been any viscissitudes in the career of the Association, but, on the contrary, it has always had a vigorous growth, continually increasing in strength and usefulness.

We have now a membership of 133, of which 110 are ordinary members, and it is annually increasing. The list of membership includes the majority of the leading gas managers in the country; but, as there are about 250 gas-works in Scotland, there is still room for a large accession to the membership, and it is the duty of all the members present to press upon all interested the importance of the work done by the Association. If those directly or indirectly interested in the manufacture of gas would only recognize what has been often said, but cannot be too often repeated, that it is not only mutual improvement which is sought in these annual gatherings, but the best and cheapest means of serving the public interests by the economical manufacture of gas, it is only reasonable to think that the advantages of the Association would be more sought after and our membership would rapidly increase.

* * * * * * * * *

Of the waste products we only now sell ammonia; but the sulphur and carbonic acid should also become an item in our returns from residual products. With respect to economy in labor, the most important item is that of the retort-house. In Scotland the majority of the works are small, or of moderate size, and, so far as we are concerned, nothing has yet been brought forward that is suited for general adoption.

Any retort charging or drawing machinery, as yet introduced, would not suit half-a-dozen gas-works in Scotland; it is all too large or too expensive to allow of its being employed, except in the very largest works; in the remainder the retort-houses are unsuited, either from their size or from their having the retort power distributed over several retort-houses, so that a number of machines would be required, thus making their adoption too expensive.

I have a strong feeling that the direction our studies should take, both to effect the economy in charging retorts proposed to be effected by machinery, and the continuous distillation of coal, is by the introduction of upright retorts, which, although not so easy of application where caking coals are employed, may be used without difficulty for Scotch cannel coal.

We in Scotch gas-works are also subject to a great loss in heating retorts, from the large percentage of ash in the fuel we have to use. It not only necessitates a large quantity of coke being employed to keep up the heats, to the loss of our coke sales, but gives a great deal of labor in cleansing the furnaces and flue-ports round the retorts; these rapidly become choked up, and the retorts covered with a coating of slag, which so effects their proper heating that it is often cheaper, or will cause less loss, to remove the retorts than to continue working them until they are done. I am of opinion that these troubles and losses would be avoided if we gave our attention to the endeavor to introduce the heating of our retorts by gas generator or productor furnaces, or by using gas produced in ordinary processes while coals are cheap, which are in use in many places where high heats are required, effecting a considerable saving in fuel. Their adoption would not only allow the heats to be maintained with regularity, but do away with all dirt in furnaces and round the retorts, together with the labor and loss connected with its removal.

The trouble and labor connected with the cleaning of purifiers, under the present method employed, make us all very anxious for the introduction of some continuous process for the removal of the impurities other than ammonia, which is the only impurity at present removed by what may be called a continuous process. A process by which all our waste products may be utilized for the purpose of sale is especially desirable; and that this very important object is possible of being realized is very evident, when we only remember the many talented minds, especially among our southern brethren, which are now directed to, and working for, this object. There is, therefore, little doubt, I think, of these being soon realized facts in daily practice.

I will mention a few matters, in a general way, that concern us all, and the first, and to us most important, item is that of coal, which, I am glad to say, is now reduced in price to as low a point as it was before the great rise in 1872-3, and there is being made a corresponding reduction in the selling price of gas all over the country. I do not, however, think gas managers should encourage such extreme reductions as leave little or no margin of profit, for I believe the interests of both gas makers and gas consumers are better served when the profit is such as to allow of the adoption, without difficulty, of the various improvements in works and processes of manufacture that from time to time arise, being carried out the moment the necessity occurs, and, by doing so, I believe it would lead to a permanent low price being maintained, instead of a fluctuating one, depending upon every contingency.

I may here further remark, with respect to the price at which gas is sold, that many consumers appear to be of the opinion that the price should be the same in all towns, and especially in those which lie near to each other. This idea, however, is quite erroneous, the difference in price of coal, the amount of capital employed, the quantity of gas sold, the conditions and arrangements of the works, the nature and extent of the area supplied, and the condition of the distributing mains, make this impossible. It is, therefore, useless for consumers to insist upon this, and their attempt to do so can only lead to annoyance and discontent.

The efficient consumption of gas is a matter of so much importance, and one that effects the interests of both the makers and consumers of the gas, that it has naturally always received a large amount of attention in the remarks of my predecessors, and has also been referred to at length in the able lectures of Dr. Wallace, Mr. M'Crae, and others. The valuable suggestions, however, contained in the lectures of these gentlemen, have not received the amount of attention and support from the public they so well deserve.

Gas consumers, who have given the matter any study, have hitherto been content to adopt some one or other of the patent burners, in order to remedy the evils complained of; but to you it is unnecessary to say the complaints of defective gas supply are not all due to the particular kind of burner used for although there is serious loss or waste of gas arising from the use of badly-constructed burners, yet there is also a waste from consuming the gas under excessive and largely varying pressures; and from the defective manner in which the houses of the consumers are fitup. There is, however, little chance of the cry of "bad gas" being done away with, until consumers realize the fact that there are certain essential conditions under which the gas must be consumed to get a satisfactory result, no matter what kind of burner is used, or quality of gas supplied.

These essential conditions are, that the interior fittings or piping be of ample size, and fitted in a proper manner; that they are in efficient working order and condition, that the burners are in good condition, and that the supply of gas is properly regulated by the consumer at the meter to suit the consumption of gas, so that it may be consumed under an unvarying and moderate pressure.

That these points will ever be efficiently attended to, until those supplying the gas take the matter in hand, there is little hope, and the necessity that we as gas managers, must eventually take the matter in hand, must be my excuse for bringing this subject before you again.

With respect to the fittings, the consumers of gas or owners of houses have usually very little knowledge of the size of piping required, or if they are properly fitted. Again the gas-fitter is frequently tied down to a price often so low, that only the use of cheapest material, put in in the shortest possible time, will enable it to pay, and the sizes of piping used are usually so small for the supply intended, that in many cases but a short time elapses, after the work is done, before the cry of bad gas points out a defective supply.

The remedy I would suggest is that gas companies should insists upon the houses being fitted up with piping, according to a certain scale of sizes to suit the number of burners in each house, and that no piping be covered in until certified that the pipes are of the right size, and laid in a proper manner; and no burners should be used but such as are either sold or approved of by the gas company supplying the gas, or some official appointed for the purpose.

The proper regulation, at the meter, of the pressure at which the gas is consumed is so necessary to economical consumption, that gas-regulators should be more generally used than they are. There is occasionally some annoyance caused by the use of defective regulators, but if those as made by Mr. Peebles be used they will give every satisfaction.

Consumers should also be reminded to use only one kind of burner in a house or place of business, as to use in one part of a house a description of burner that requires excessive pressure to get the required quantity of gas through, and in another part the ordinary open burner, can never give a satisfactory result.

It would also have a tendency to do away, on the part of consumers, with the complaints of excessive accounts, if the meters, instead of being placed so as to be very difficult to get at, were put in some convenient place, where the state of the index might be seen at any moment without trouble, and if consumers were advised to learn to read the meter for themselves, which, as you know, can be easily acquired in a few moments

by any one of ordinary intelligence. In fact, it is absolutely necessary that gas managers do all in their power to remove that feeling of suspicion which so many gas consumers have, that they are not honestly treated, and to do away with that air of mystery which, to the minds of many gas consumers, appears to belong to the manufacture and supply of gas, and for neither of which is there the least just cause. For, notwithstanding all that may have been said to the contrary, I have no hesitation in saying that we, as gas managers, have no desire to charge consumers other than fairly and honestly, and that the accounts of gas companies are as honestly and carefully made up as the accounts of other manufacturers.

It has been recommended that, in order to avoid waste in the consumption of gas, an improvement be made in the arrangements for burning the gas. Chandeliers are usually hung too high up, by which a great deal of light is wasted; if they were hung lower, or if, when convenient, brackets were used, less gas would be required.

It is, no doubt, from this cause that parties who use paraffin or oil lamps, when gas is dear, say they find it cheaper, simply because they place the lamp upon the table, or where the light is needed, instead of up in the ceiling, where it not required.

There is also another question which is receiving a good deal of attention, and that is the quality of the gas. To remove the cry of dear gas, some are proposing to make a reduction in the price by reducing the quality, and suggest the use of improved burners, by which 22-candle gas can be made to give the same results as 28-candle gas; but I do not think this object is likely to be soon obtained, for, supposing every one to be supplied with suitable burners, it is hardly possible that they would be kept, or would continue in that efficient condition necessary for perfect consumption. And, again, it appears to me that if it is possible to supply such burners, and keep them in a perfect condition, it is just as easy to supply burners that will make 28-candle gas give the same results as 34-candle gas; and I think there cannot be a doubt that the consumers would be much better served in the latter case than in the former.

The mode by which cheaper gas of lower quality is to be supplied is, I understand, by the use of second-class cannel and splint coals, the better price got for the coke, and saving of expense on first class coals going to cheapen the cost of manufacture; but it is very evident that if these coals were used in quantities, which would then be necessary, they would increase in price until they equalled any increased value got for the coke, and saving of expense for first-class coals. It is, therefore, very doubtful if any saving would be made in the cost of manufacture such as would permit of any great reduction in the price of the low-quality gas; but, supposing such saving could be made, and the plan adopted, it is plain that it would not do for towns here and there to take up the principle, but it must be done generally all over the country at the same time; otherwise, however cheap the gas at which the public in low-quality towns were supplied, the consumers would insist upon having the better quality that their neighbors were getting, no matter what the difference in price between the places.

But, to say nothing of the many difficulties to be overcome, I suspect that so long as the rich cannels can be got, as it were, at their very doors, the public in Scotland will insist upon the rich quality of gas being supplied them.

Indeed, I suspect that instead of supplying a low quality of gas at a low price, there is more probability of satisfying the public by giving them an improved quality at a moderate price; in fact we, in Scotland, have an individuality, or I might say nationality, in the quality of our gas supply, which I expect will continue until first-class cannel coals become too scarce, and consequently too dear, too permit of our using them. —*London Journal of Gas-Lighting.*

The Manufacture of Coal Illuminating Gas.*

By Alfred P. Trautwein, M. E.

Continued from page 112.

We now have to examine the

CRUDE MATERIALS

which are available for the purpose of gas manufacture. The most important of these are the various kinds of coal, wood, and organic substances, and petroleum, naphtha, and similar hydrocarbons, and the gas thus produced is called, according to the materials from which it is prepared, coal illuminating gas, wood gas, and petroleum or oil gas; in this connection, finally, mention might be made of the so called water gas.

The subject of this paper being the manufacture of illuminating gas from coal, it might be considered desirable to give the reasons which determined this selection, and it will not be amiss, therefore, to discuss briefly the advantages and disadvantages attending the manufacture of gas from materials other than coal.

WOOD GAS.

The fact that gas may be obtained by distillation of wood, peat, and the like, occupied the attention, as we have already seen in our historical sketch, of Lebon, a French engineer, as early as the year 1799. The illuminating power of the gas, however, could not have been great, since, when produced at a temperature sufficiently high to char wood, it consists mainly of carbonic oxide and marsh gas which, as is well known, are non-luminous, while the percentage of luminous heavy hydrocarbons is very small. If well seasoned and thoroughly dried pine be used, with the temperature sufficiently high, a gas of great luminosity may be obtained; in its crude state, however, it contains large quantities of carbonic oxide—in some instances as much as 40 per cent—carbonic acid 10 per cent., hydrogen 20 per cent., and marsh gas and light hydrocarbons 23 per cent; in order to remove the carbonic acid thoroughly it is necessary to employ a large quantity of hydrate of lime, and this is one of the great objections to wood as a material for gas manufacture. The large percentage of carbonic oxide is a second serious objection in every respect; and then, too, the expense of properly preparing the wood is a further drawback to its use for these purposes. Wood gas has its advantages, it is true, but it has never been applied on a large scale for any length of time; it was used temporarily in a number of our southern cities during the late war, but it was speedily abandoned when a satisfactory coal supply was secured. It is in use, on the other hand, in several villages out West, where wood is plenty and coal is scarce; but even here it is rarely used alone, being enriched in most instances by means of oil gas. The same remarks, essentially, apply equally well to the case of gas made from peat: this evidently is limited in its application to those localities where peat abounds—the expense of preparing and then transporting a bulky article such as peat, being too great to enable it to successfully compete with other gas-making materials.

OIL GAS.

The manufacture of gas from resin, oils and similar hydrocarbons, formed the subject of many experiments at even as early a period as that from coal itself, the first patent in this direction having been granted in England to John Taylor, on June 13, 1813, No. 3929. The first gas made in New York and Philadelphia was from resin and oil, but in the course of a few years coal gas was substituted. At present resin is rarely, if ever, used in gas making.

The manufacture of gas from petroleum, naphtha, and other similar hydrocarbons, on the other hand, forms a much more fruitful field for invention, and consequently a very large number of processes to this end have been and are still being suggested and tried. Such gas is in use at present in quite a number of small towns, villages, and mills in different parts of the country, and, it is stated, with considerable success, It is generally believed, however, that at the present prices of petroleum, with an immediate prospect of a further increase, it cannot compete in cheapness with coal as a gas-making material, and then only in very exceptional cases. Petroleum gas undoubtedly has a number of very important advantages, among others that the plant and the labor required in the manufacture of the gas are not as great as in the case of coal gas, the expense of purification is reduced to almost *nil*, being free from sulphur and ammonia compounds, while a better gas in some respects is obtained; it would not be difficult, on the other hand, to cite a number of equally important disadvantages which are invariably connected with the processes of manufacture as now practiced. Then, too, the whole subject of petroleum or naphtha gas is one in regard to which a great diversity of opinion exists among the members of the profession; many claim that when used at all, it must be diluted with either air or better still with water gas in order to make it a marketable product, while others, on the contrary, contend that such a course is radically wrong, and that it is simply necessary to consume it in appropriate burners and in its unadulterated state. The subject has received a vast amount of attention, particularly in this country, and therefore forms a most comprehensive topic, so much so indeed that it was thought advisable not to attempt a discussion in this connection and at any length, of the value of petroleum as a material for gas manufacture.* Oil gas, moreover, has never, to our knowledge, been used *alone* on so large a scale as 500,000 cubic feet per diem. Naphtha, it is true, has been and is now being used to some extent for the purpose of "enriching" the poorer qualities of coal gas, and it might perhaps have been similarly employed here. Just at present attempts in this direction are being made at several works in this immediate vicinity as well as elsewhere, and in at least two instances with some success. There is no doubt, however, that the subject is still a matter of experiment, but one promising good results.

We now have to speak of what has been called

WATER GAS.

for the manufacture of which numerous processes exist. The general principles upon which they all depend, may briefly be stated as follows: When steam, preferably superheated steam, comes in contact with red hot carbon either in the form of coke, charcoal, or anthracite coal, it is immediately decomposed; the hydrogen is liberated, while the oxygen combines with the carbon to form carbonic acid, and particularly carbonic oxide. These gases being non-luminous, it is necessary to furnish them with an illuminating element in some convenient form, and this is done by what is technically termed "carburetting" the gas, that is to say, by charging it with the hydrocarbon gas obtained from petroleum or naphtha. This carburetting, then, amounts in reality to nothing more than enriching the gas as is done in the case of poor coal gas; the same remarks, therefore, which have previously been made in regard to oil gas, apply with equal force to the case of water gas. In addition to this it may be stated that of the many water gas processes which from time to time have been proposed and tried, all with one or two exceptions have completely failed. A good illustration is afforded by the case of the Spencer process, which, though involving a number of peculiarities in the details of the plant, differs in principle but slightly from other processes. Some two years ago it was in use on a large working scale at a works in the immediate neighborhood of New York city, but it was speedily abandoned, the main difficulty appearing to have been the enormous carbon deposits at all points in the process.

It is not to be understood, on the other hand, that these water gas processes are failures in every respect, and although their success in the future would not appear to lie in the direction of illumination, yet

* A Graduating Thesis at the Stevens Institute of Technology.

* Its merits will be found fully discussed, in a report made by Mr. H. H. Edgerton to the Fort Wayne Gas-Light Co., in "Gas-Light Journal," April 3, 1871, *et seq.*

it is not at all improbable, that we may have to look towards them as processes for the manufacture of heating gas.

It is greatly regretted that the reasons—and they are quite numerous—which determined the choice of coal as the raw material for the projected works could not, in the first place all be given and then not as fully as might have been desirable; both time and space, however, did not permit of a different course being taken.

Having, then, decided upon the use of coal in the manufacture of illuminating gas, it is but natural to look about and see which of the many kinds of coal are suitable for our purposes, and nothing will enable us to to do this more rapidly and satisfactorily than a cursory sketch of the geological formation of the several coals.

It is well known that they are the fossil remains of vegetable matter; the processes by which they are formed, however, are even now the subject of considerable speculation. The simplest and, at the same time, the most probable of all the theories that have hitherto been advanced is, that the process by which this was achieved was one of very slow decomposition, aided by heat and by the enormous pressure of superincumbent strata, and whose tendency was to separate the carbon in a state which approached almost absolute purity. We should, therefore, not expect to find this decomposition to be as complete in the case of the so called lignites or brown coals, which still retain to some extent the appearance of the original woody fibre, as in the case of the older stone coals, which in this respect present an entirely different appearance. Now, it sometimes occurred that in some instances this process of decomposition went on more slowly or as the case may be, more rapidly than in others, and consequently coals will be found to vary considerably both in their chemical composition and their physical properties. There are varieties, for instance, possessing besides pure carbon, which, being the least volatile of the constituents, remained longest, quite a percentage of hydrogen and oxygen; then again there are others in which the process of decomposition has gone so far that the more volatile elements have almost completely separated, leaving fully 93 per cent. of pure carbon. The former are known as our bituminous and the latter as our anthracite coals.

Now, as we shall subsequently see, gas manufacture by the ordinary method involves the destructive distillation of coal; we should, therefore, expect that coal to be best suited for this purpose which contains least free carbon and most volatile matter. For this reason the anthracite coals cannot be used: they are only then capable of being transformed into gaseous products when supplied with another gaseous body—the oxygen of the air, for instance, for which the carbon has a wonderful affinity; in this manner, though the anthracites are entirely useless for our purposes, that is, those of gas manufactu by the ordinary methods, they are most excellent when used as fuel.

The bituminous coals, on the other hand, have not undergone so entire a transformation; the volatile elements have not yet been liberated, a certain amount of oxygen and more especially of hydrogen in the form of hydrocarbons are still retained, and upon these constituents is based their value as materials for gas manufacture. In selecting a coal for this special purpose, however, other qualities, not common to all the bituminous coals, require to be taken into consideration. Some varieties, the dry, bituminous coals, for instance, decrepitate on being heated, and are decompcsed without becoming soft or pasty—in other words without "caking" as it is technically called. These are of little or no value for our purposes, since the decomposition, from their peculiar nature, must necessarily be both incomplete and at the same time must proceed very unevenly. Those coals, on the other hand, which cake freely and uniformly, contain a large percentage of volatile hydrocarbons, and but little sulphur in the form of the sulphides of the more eommon metals and which, finally, leave but little as h on being burnt, are most excellently adapted for gas manufacture. This class of bituminous caking coals, therefore, is usually known under the name of "gas coals." The best of these should contain about two per cent. of "fixed" and four per cent. of "disposable" hydrogen (Wagner's Chemical Technology).

In addition to the coals may be mentioned under the head of "crude materials," the several bituminous shales and the so-called "asphalts.' Though not often used on account of their high price, it is not unusual in many works to have a small supply of them on hand, for the purpose of increasing the candle power of the gas, if it happen to fall below the standard.

Having, then, become acquainted with the classes of bituminous coals and other crude materials which are at our disposal, it now becomes necessary to decide upon those gas coals which would appear to be most suited for our given purpose.

COALS FOR PROJECTED WORKS.

These being located in the State of New Jersey, somewhere between New York city and Philadelphia, it would probably be found to be most economical and generally advantageous—unless a special arrangement for the supply could be made—to use those coals which already serve as gas-making materials in this section of the country.

It was formerly customary in this as well as in other parts of the United States, to use English and British Province coals to the entire exclusion almost of our American coals, and even now there are instances in some of our Eastern States in which this state of affairs still exists. At present, however, but few works in this vicinity use foreign gas coals at all, and our managers have found that, although the Newcastle caking and the Scotch cannel coals are less sulphurous than our native American coals, yet the economy secured by the use of the latter is much greater in the long run than would appear at first sight. The projected works, therefore, will be limited to the use of American coals only. The coals which thus are at our disposal are so very numerous, and many are so nearly equally good for our purposes, that the definite selection will be a matter of some difficulty.

The coals which are used in and about New York city and by the Philadelphia City Gas Works, are for the greater part derived from the Youghiogheny coal field near Pittsburgh, Pa., and from that region in West Virginia, which is traversed by the Kanawha River. Among the former we may mention the Penn, Westmoreland and Youghiogheny caking coals; though some of our managers seem to give the preference to the latter coal, yet they are practically of the same quality. They rank among the best of our American coals and yield per long ton, an average of about 9,500 cubic feet of gas, having an illuminating power of 16.5 condles. The Waverly and Red Bank Orrel coals are also considered good gas coals, but with us they are not as largely used as are the coals already named above. The West Virginia coals, too, are quite numerous and are extensively used. The Murphy Run and Despard coals may be found in use in several large works in this vicinity; the same is true of the Cannelton, and to a less extent of the Newburgh Orrel and the Fairmount coal. The average price of the coals which have thus far been enumerated, varied during the last few years rom $6 to $6.50 per ton, delivered in New York.

Comparing these coals with those from the British Provinces, we will find the advantages greatly on the side of our Pennsylvania and West Virginia coals. Prof. Charles F. Chandler gives the percentages of sulphur in these coals as follows:

Nova Scotia, Cape Breton, from 3 % to 5 %.
Red Bank, Pa..... .89 %.
Westmoreland. Pa..... 1.50 %.
Murphy Run, W. Va..... 1.88 % to 3.06 %.

Among the Nova Scotia coals which may be found in our markets, we may mention the Block House from Cow Bay, as being in use in one of the largest works in New York city. It is preferred mainly because of the excellent quality of coke which it yields; that it is a very "dirty" and sulphurous coal, however, is made evident by the fact that a bushel of hydrate of lime purified but 3,800 cubic feet from a mixture of one-third Cow Bay and two-thirds Westmoreland coals, while when the former alone is used there is no difficulty whatever in purifying 6000 cubic feet of gas per bushel of lime. Other Nova Scotia coals like the Picton, Glace Bay and Lingan coals are even more sulphurous.

Of the several cannel coals we may note as being in very general use as enrichers, the Peytona and Cannelton cannels from the Kanawha Valley and the Red Bank Cannel from Pennsylvania.

As has previously been stated, there is but a very slight shade of difference, if any, between the Penn, Westmoreland and Youghiogheny coals; keeping in mind the fact that the amount of volatile matter in these coals and the yield of gas per ton is as high almost as in any of the others, that the amount of gas purified per bushel of lime is much greater than in the case of the other coals, and that the coke is of a very fair quality since it contains but little ash, it would appear on the whole to be most advantageous to use the coals which have just been enumerated. The Despard coal, it is true, is superior to them in some respects: on the other hand, the yield of coke is not only smaller but of an inferior quality, by reason of the great percentage of sulphur, whose tendency is to cause the formation of clinker when the coke is burnt as fuel. It also appears that the percentage of ash in the Kanawha coals is unusually small, while that of the volatile constituents is somewhat above the average, but we were unable to obtain sufficient data to permit us to judge fairly of their merits as gas coals.

The coals which we have selected for the projected works are in more general use in this vicinity and in Philadelphia, than any other of the coals which we have enumerated. One of their shipping ports is South Amboy, N. J., which would probably be the most central point for the coal supply of the new works. In regard to the final selection of the cannel coals which will be used for the purpose of enriching, the choice lies between the Red Bank coal from Pennsylvania and the West Virginia cannels. The former of these is not as largely used in this section of the country as the latter, and since no reliable data in regard to the Red Bank coal could be obtained, we are restricted to the use of the West Virginia cannels; no particular coal is here given the preference, because they are all generally considered to have very nearly the same value for the purpose in question. It is well, however, to limit their use as much as possible, not only because of their high price, but also of the fact that the resulting coke is of an inferior quality.

The several bituminous shales and asphalts, or "enriching materials" now require a few words; their great cost precludes their general use, but it is usual in many works to have a small supply on hand, in order to be fully prepared for such emergencies as an abnormally low illuminating power in the gas. The most common of these materials are the Hartley mineral from Australia, containing 82 per cent. of volatile matter, the Albertite from Nova Scotia which contains but 4 per cent. of ash, and finally, our Virginia Grahamite, yielding 15,000 cubic feet of twenty-eight candle gas per ton.

[To be continued.]

North British Association of Gas Managers.

[From Report in "London Journal of Gas-Ligeting."]

Mr. D. Bruce Peebles (Edinburgh) read the following paper on—

GAS GOVERNORS, WITH DESCRIPTION OF PEEBLES' PATENT GOVERNORS FOR STATIONS, DISTRICTS, DWELLING-HOUSES, AND PUBLIC LAMPS.

In the early days of gas-lighting, amongst many other difficulties encountered by gas engineers, that of controlling pressure must have obtruded itself persistently and vexatiously, and none the less so that its influence in modifying the quantity and quality of the gas produced, and economizing its consumption, was not so well understood or appreciated as in the present day.

The exhauster was then unthought of, so that in the very first process of the manufacture the production of gas was hindered, while, after it was made and stored, the influence of pressure was again felt in the difficulty experienced in retaining it in the vessels and pipes for distribution. The excellent manufactures in distributory plant at the service of the gas engi-

neers of the present day were not then to be had; indeed, so difficult was it to obtain service-pipes, that old gun barrels were pressed into use, and patents taken out for making pipes of wood and of paper. With such materials as these, the jointing must of necessity have been very imperfect, and leakage—that nightmare which even now haunts the pillow of many a gas engineer—must have been a source of irritation annoyance and loss.

From the valuable annual report of the West of Scotland Gas Managers Association for 1875–6, lately published, out of 68 Scotch gas companies, whose managers filled up the leakage and unaccounted-for gas column, we find—

11	companies having a loss of from	7 to 9	per	cent.
15	"	" "	"	"
21	"	" 15 to 19	"	"
14	companies having a loss of	20	"	"
3	"	" "	22	"
2	"	" "	24	"
1	"	" "	25	"
1	"	" "	33	"

With such results, even with the excellent pipes and tubes now made by many eminent firms, employing machinery of the most perfect description, and devoting their whole time and attention to the manufacture, what must leakage have been in early times, when engineers had to use any kind of makeshifts, and had no proper means of even estimating or checking the loss therefrom? In order to clearly understand the effect of pressure on leakage, we shall only consider the results of a single experiment on the discharge of gas through an aperture at different pressures If we take a piece of metal half an inch thick, and drill a hole through it 2-10ths of an inch in diameter, as representing a small leak in an ordinary 6 or 8 inch gas-pipe, we find, through this small aperture, the discharge of 28-candle gas to be as follows:

Pressure.	Quantity per hour.
0·5 inch.....	42·603 cu. ft.
1·0 "	59·016 "
1·5 "	73·479 "
2·0 "	94·805 "
2·5 "	66·512 "
3·0 "	102·857 "

Delivery of atmospheric air through an aperture of the same dimensions—

Pressure.	Quantity per hour.
0·5 inch.....	33·953 cu. ft.
1·0 "	42·105 "
1·5 "	52·172 "
2·0 "	60·000 "
2·5 "	66·512 "
3·0 "	73·069 "

The specific gravity of air being 1·000, and 28-candle gas about 0·645, we would, of course, have a much greater leakage with 15-candle gas, having a specific gravity of about 0·443. In these experiments, no account was taken of temperature or barometric pressure. They merely show approximately what an enormous loss may take place by continuous leakage through cracks in pipes or badly made joints, and also the effect of pressure in increasing or diminishing the loss. We here have a discharge of 42·6 cubic feet per hour at 5-10ths pressure, and by an increase of only 10-10ths, the delivery is as nearly as may be doubled.

This gives us some idea of the necessity of keeping down pressure in the mains to the lowest possible point compatible with a proper supply to consumers, and it also accounts for the ruinous results which must and do take place where there are badly-laid mains, and the gas let away freely from the gasholders without check or hindrance.

As might be expected, the attention of gas engineers was soon directed to the necessity of getting some method of modifying and controlling pressure, and the first attempt seems to have been made by Clegg in 1815. In that year he patented a governor theoretically the same as those now in use, although deficient in one of the most essential parts—viz., the cone valve. Improvements were soon made, however, as we find that Accum, who wrote a treatise on the manufacture of coal gas in 1819, described and illustrated a governor, having a cone attached to the dome of the bell, and closely resembling the instrument of the present day. Peckstone, another writer on the same subject in 1851, gave a description and drawings with little, if any, improvements on the governor described by Accum. Attention had not then been so thoroughly roused to the importance of the subject as it should have been, if we may judge by the patent list, as we find only 15 patents taken out between the years 1815 and 1841; but between the latter date and up to 1866 no less than 249 patents were granted, while since then every year has added largely to the list. nor does there seem any likelihood of inventors leaving the governor alone even now, so that ultimately we may expect to see a perfect instrument.

Notwithstanding the labor that has been bestowed upon it, and the time that has been spent in endeavoring to improve it, no great progress has been made, and not much novelty introduced either in its construction or action.

It would be a worthless task to enumerate or describe the many varieties of governors which have been invented or even manufactured, and we shall, therefore, only consider those which have come into ordinary use, and which experience has proved to be reliable instruments, although, in doing so, many may be missed, having good points in their favor.

Beginning with Clegg's governor, which deserves our special consideration, as being the first model of an instrument which has come into such general use, we find, on looking at the drawing, that we have a bell or holder working in a tank amongst water, with a pipe standing above the water-level, for the admission of regulated gas between the top of the bell and the water. A beam is supported on a piller, and works on an axis in a similar manner to an ordinary scale beam. At each end an arc is formed for chains working over, to one of which is attached the bell, and to the other the balance weights. On an arc nearer the centre of the beam a chain is hung, to the end of which a cup containing mercury is attached. Dipping into the mercury is a pipe, having a partition, the conduit on one side of the partition being connected with the inlet gas, that on the other side with the outlet gas. At the bottom of the partition is an aperture, which is closed or opened as the cup with mercury is raised or lowered. When the outlet pressure required is adjusted by the balance-weights, there should then be no variation, because, should the initial pressure be increased, the aperture is proportionately closed, while, if it be decreased, the aperture is opened in a corresponding degree with the same result. A responsive action takes place also with the varying rates of consumption. If a large supply is wanted, the gas is drawn away from under the bell, which immediately falls, opening the aperture; while, if consumption decreases, the bell immediately rises, giving a less supply at the same pressure.

We may notice particularly here, that in Clegg's governor, which is the prototype of all those now in use, we have a constant outlet pressure, with a variable opening.

Four years after the date of Clegg's patent, Accum published his treatise on the manufacture of coal gas, and in it we find the float governor clearly described. The drawing shows us the instrument, having a bell with annular float attached to it, and a cone valve hung from the dome of the bell. The float serves the same purpose as the back balance-weights of Clegg's governor—viz., to raise the bell and diminish the gas supply. The result of the action is also the same as in Clegg's, but the cone valve was an immense improvement on the mercurial seal, as it was much more delicate in its action, and obviated all danger of blowing. The three varieties of station governors most extensively used at the present time are the beam governor, the wheel governor—which is merely a modification of the beam—and the float governor. With these we are all familiar, and if we compare them with those we have now described, we see how little advance has been made, and how closely the two early types have been followed.

Coming between the wet and dry instruments, is the mercurial governor, which, so far as I know, has only been used for house purposes. These have been made by Mr. Hulett, of London, who patented his arrangement in 1854. A later form is that made by Mr. Busch, of Oldham. He employs a bell made of glass, which works in a mercurial seal, the valve being suspended from the glass bell in a similar manner to the governor invented by Loos, which we shall notice when we refer to lamp governors. These mercurial governors give very good results, but mercury is expensive and awkward to work with, while its tendency to act on other metals is somewhat against its use. Accidents have not been uncommon from its being spilt into gasometers, whereby the block tin cylinders and pipes have been destroyed. No doubt, for some of these reasons, the mercurial governor has not come into such extensive use as it otherwise would have done.

The first really useful dry governor was invented by Samuel Crosley, so far back as 1825, and although it is 51 years since his specification appeared, it might be fairly used to describe the dry governors of the present day. No doubt many of them are modified and considerably improved, but the action of the whole of them depends on the use of a flexible diaphragm raising a plug or valve, or actuating a lever, to which the valve is attached. We shall examine the house governors before us later on. Meantime, the high-pressure governor invented by Mr. Duckham may be mentioned here as one suited for using with compressed gas. The peculiarity of his arrangement is, that the diaphragm is connected with the long arm of a lever, to the other or short arm of which this valve is attached. This governor was in use on the Midland railway some years since, when compressed gas was tried for lighting the carriages. The system did not give satisfaction, and was abandoned; but not from any fault of the governor.

Besides sending out gas, and controlling it, so as to give a proper average pressure to the level parts of cities and towns, there are districts of great elevation to be supplied, such as we have in Edinburgh. To illustrate this part of the subject, we may refer to the position of the Edinburgh and Leith gas works, in connection with one or two of the elevated districts to which the gas is supplied. Setting aside the gasholders at Canonmills, and assuming that the gas is sent from Baltic Street, Leith, we have Princes Street, at an elevation of 206 feet, Liberton, 236 feet, and parts of the Lawn Market 288 feet above the level of the work; and as pressure increases about 0·1 inch on a water-gauge for every 10 feet of altitude, and the minimum day pressure at Leith is 0·8 inch, we have in the daytime a pressure of about 2·9 inches at Princes Street, 3·1 inches at Liberton, and 3·6 inches at the Lawn Market.

The night pressure at the Leith works is 1·7 inch, so that 0·9 inch should be added to the above day pressures, to give the night pressure at the three elevated points named, which, however, will be considerably modified by the variable consumption going on between the works and these districts, and also by the friction in the pipes. To remedy this accession of pressure, an automatic instrument is required, which will respond and act in sympathy with the station governor at the works, reducing or increasing the pressure at the district when it is increased or reduced at the works. It will be obvious that an ordinary governor cannot do this, because, as we have seen, when once it is adjusted, the outlet pressure remains invariable, unless the weights are altered.

The late Mr. Orlando Brothers, of Blackburn, one of a family of talented gas engineers, invented a very ingenious governor for district purposes. It consists of a cylindrical case, with inlet and outlet pipes, as in the ordinary governor, and the bell or holder is formed with what is termed a difference chamber, as seen on the drawing. This difference-chamber is connected with the atmosphere by a pipe, which supplies or discharges atmospheric air as the holder rises or falls. The tank or casing is closed by a cover, and gas is admitted between the cover and the top of the bell by a small tube communicating with the inlet pipe. It will be observed, also, that the air-chamber or float

extends from the bottom to the top of the bell, so that, as more water is poured into the tank, the greater will be the buoyant power of the float, and the stronger its tendency to close the valve.

Supposing the governor to be fixed at some of the districts named, at a distance from the works—say Princes street, which is 200 feet higher than the site of the Leith gas works—the tank is then filled to the water line and gas turned on. We see that the gas has free entrance to the space between the bell and the outside casing, and acts upon the full area of the top of the dome, tending to force the bell downwards, while gas, at the same pressure, ascends through the annular space between the two pipes, and acts upon the under side of the dome, tending to force the bell upwards. But the area on which the gas acts on the under side of the dome is decreased by the space taken up by the float and the difference-chamber, so that while the same pressure is acting on the upper and under sides of the dome, we see that the area on the under side, subject to the action of the gas, is only about half that of the area on the top side. The stronger the initial pressure becomes, therefore, the greater power will it have to force the bell downwards and open the valve, and as the initial pressure decreases, the bell will rise by the power of the float and close the valve, and we now observe that all that is necessary for adjusting the governor to any required outlet pressure is to fill in or run off the water in the tank.

If the outlet pressure be too high, water must be added until the float raises the holder or bell, and so far closes the valve until the pressure desired is obtained, and the opposite course is to be taken if a heavier outlet pressure be required. When the governor is adjusted, all that is necessary, in order to maintain the desired outlet pressure, is to keep the water at the proper level, and so long as an unvarying inlet pressure is maintained, the district governor will give the same outlet pressure. It is, therefore, perfectly automatic, responding to all the changes of pressure established by the station governor, increasing or diminishing pressure as it is increased or diminished at the works. Shortly after Mr. Brothers's appeared, Mr. Cathels invented his district governor, and from the drawing we observe that his improvement chiefly consists in turning the valve of the ordinary governor upside down, and reversing the pipes. By doing so, he at once got the responsive action in a simple way, and although his invention is suitable for a wet governor, he seems to have entirely abandoned it in practice as being unsuitable for connecting with mains at a distance from the works. His dry district governor consists of a flexible diaphragm moving freely within a chamber, and having a valve of a parabolic or hemispherical shape suspended from it, with its apex or small end downwards.

The inlet gas is led directly into the chamber below the diaphragm, and therefore every variation of the inlet pressure tends either to open or close the valve. When the time of lighting up comes, and an additional pressure is put on at the works, it acts immediately on the diaphragm of the district governor, opens the valve, and gives a proper night-supply to the district, and when pressure is taken off at the works, the diaphragm responds and closes the valve until the desired day pressure is established.

We notice that with both of these governors a constant outlet pressure may be got, but only if there be no variation in the initial pressure. If it varies either, by the action of the station governor, or from a varying consumption taking place between the two governors, the district pressure will also vary.

So far as instruments of pressure are concerned, we have only now to consider governors for single jets, such as are used in public lamps, and of these there are many varieties in form and construction.

We have before us a number of these governors by different makers, from which their general construction may be clearly seen. All of them, except one, depend on the action of a flexible diaphragm, the exception being a mercurial governor by Loos, already referred to, which is worth examining. There is an ingenious arrangement for carrying the gas to the burner, and the instrument is simple, small, and neat in form. Mercury is poured into a channel in which the bell works, and from the bell a valve is suspended, which opens and closes, according to pressure, as in the ordinary lamp-governors.

We have stated that Clegg's governor, and all of that type, are pressure governors, they give a constant pressure with a varying delivery; but there is another class which give a constant delivery with a variable pressure. With the first, a constant pressure is maintained, whatever may be the variation in the consumption; with the second, a constant volume is delivered at a variable pressure, according as the size of the orifice or the number of the burners varies.

The first volumetric governor seems to have been invented by Mr. John Leslie, in 1841. It consists of an inverted vessel or bell, working in oil, and having a cone fixed on the dome of the bell, which works in a seat placed in the cover of the casing. He named it an Automatic Gas Economizer; but like others of this class, it is only suited for single jets, or for supplying a specified and unvarying number of lights. The action depends upon the bell being sustained between two pressures, which have a constant unvarying difference. In this case the gas is delivered through an invariable orifice at an unvarying pressure, the valve being employed to establish the differential pressure on which the action of the apparatus depends.

In 1870 M. Henri Giroud, of Paris, working in ignorance of what had been done, reinvented and patented a governor, the action of which is exactly the same as that of Leslie, although he modified its construction, and brought it into a more suitable form for using with single burners. He named his apparatus a Rheometer, or flow measurer, in contradistinction to the pressure-governor. From the drawing we see that it consists of a closed cylindrical casing, into which a very light bell is placed in a circular channel filled with glycerine. The invariable orifice is made in the dome of the bell, and on the top of the bell the valve is placed, which works in a seat in the top of the casing, the same as Leslie's. The other drawing represents a disc theometer, in which glycerine is dispensed with. While giving Giroud much credit for what was, no doubt, an original invention on his part, and for the ingenuity with which he has carried out his ideas, we are bound to say that he was completely anticipated by Leslie, to whom the honor of the invention doubtless belongs

About 12 or 13 years ago a very serious accident occurred at one of the large gas-stations in London, caused by the bell of a gas-governor tilting and allowing an escape of gas, which, mixing with atmospheric air, caused an explosion resulting in great loss of life and destruction of property. Many modifications of the governor were proposed to prevent the recurrence of such an accident, but no great improvement resulted from the numerous suggestions then offered. Guide rods and stops to prevent the bell from rising too far or tilting were in many cases adopted; but the accident was soon forgotten, and the old forms manufactured as before. I formed a very strong opinion then that all the vessels or instruments in gas-works shut up in rooms, and having no free communication with the atmosphere, should be gas tight. About eighteen months ago another accident happened in Accrington, also from a governor, and although no lives were lost there, a good deal of property was destroyed, and had it not been for the prompt measures taken by Mr. Key, then manager, the result might have been serious indeed. This strengthened my previously formed opinion, and I dare say there are few but will agree that it would be most desirable to render every vessel or instrument used in a gas work gas-tight, so that an escape would be impossible.

The ordinary governor seems, and really is, perfectly safe, when in proper working order; but yet, what has happened may happen again, and, therefore, any approach to securing a gas-tight governor, is a step in the right direction.

[To be concluded.]

Correspondence

[Correspondents, in all cases, should sign their communications with their names and address in full—not for publication, unless desired, but as a guarantee of good faith.—Ed.

Wood Gas.

Geneva, N. Y., August 22, 1876.

Mr. Editor: Some weeks since you published in your valuable paper, a report furnished you by Gen. Roome, President of the Manhattan Gas Co. of your city, of the result obtained by two scientific men, in their experiments in making illuminating gas from wood; and in your preliminary remarks you intimated that this report would be of interest, because a new process of making wood gas was being offered and canvassed by gas engineers.

I noticed in this report, which was made more than twenty years ago, that the gentleman described their results as being produced by *low* heat, and that tar and pyroligneous acid were among the resultants, with about 4½ feet of gas to the pound of wood, which might be utilized for illuminating purposes.

The world moves, and has turned upon its axis many times within the last two decades; it is an age of improvement, and in this communication it is my purpose to show that improvements in gas making are as valuable as in any other department of science, and gas making *is* a science. Men who made gas twenty years ago, make it to day, in substantially the same way, and they are the hardest men in the world to convince that a good merchantable gas can be made in any other way or from any other material, than coal. Nothing but stubborn facts will convince them, and then only when the fact will touch their pockets.

And for the facts. I have been spending some days here, investigating the manufacture of wood gas, enriched with naphtha, and have been offered every facility in my investigation by Mr. W. W. Horten, the gentlemanly and intelligent manager and lessee of the Geneva Gas Works. Mr. Horten took possession of the works in March last, when high prices ($4 per thousand) poor coal gas and hard times had run the consumption down to 4000 feet per day. Every hotel, and nearly every store, and saloon, and a very large proportion of the private houses were using kerosene, that most successful of all competitors of gas. Now every hotel, nearly every store, and a large proportion of the dwellings are using gas, many of them not only for illuminating but for culinary purposes. The question may be asked, why this change, and it is easily answered. Low prices and good quality—so good that oil cannot hold a candle to it

Upon taking possession of the work, Mr. Horten adopted the wood and oil process, and reduced the price from *four* to *two dollars and thirty seven and a half cents* per 1000 feet. The consequence is that although we have had short and hot evenings all summer he has *tripled* his consumption, and will have for the year, an average of more than four times the daily consumption prior to his becoming the lessee.

But I am spinning too long a yarn and will give the facts, as I derive them from Mr. Horten's books. I find that from 100 lbs of ordinarily seasoned wood and 3¼ gallons of crude naphtha, he has daily produced an average of 1090 feet of 20 candle gas, and a much better article than can be found in any city but Detroit.

A correspondent of yours, from Iowa, admitted the fact as stated by Prof. Marsh, but denied that the results obtained by him could be continuously had, and claimed that they were exceptional. Mr. Horten has been running the works here over five months, and has always exceeded 1000 cubic feet to the 100 lbs. of wood.

I visited, a few weeks ago, the works at Woodstock, Canada, on the line of the Great Western Railway, and there I made the same investigation that I have done here, and found even better results, for there I saw 1320 feet of 20 candle gas made from 100 lb. of

pine slabs, and four gallons of the crude petroleum of Canada, holding in suspension not less than 25 per cent. of water.

Mr. Horten is nsing bituminous coal for fuel, consuming in fourteen days, four tons, costing $4.50 per ton, and his heats are the *finest* I ever saw. He is paying 12 cents per 100 lbs. for his wood and 5½ cents per gallon for his naphtha. From these facts and figures, manufacturers of gas can determine the cost per 1000 cubic feet, and I am satisfied they will be astonished. Twenty-five thousand feet can easily be made in an ordinary bench of threes in 24 hours, and the labor is far less than making coal gas, *but the heats must be kept up.*

This serious question arises—Why are so many gas companies in an al ost bankrupt condition? Easily answered again—High prices and poor gas. Consequently the meters come in and the customer is lost. For one I am satisfied that the Geneva Gas Works show a better condition of things and greater prosperity, than any set of works in the country, and self-interest would seem to dictate that they be critically and carefully examined by all interested in gas making. Mr. Horten says he is "ready to receive company."

GAS ENGINEER.

American Gas-Light Association.

[The following letter speaks for itself. In accordance with permission therein contained it is sent to us for publication.—ED.]

ROCKFORD, ILL., Sept. 11, 1876.

CHARLES NETTLETON, ESQ.,

Sec. American Gas Association.

Dear Sir: In reply to your circular of enquiry as to some name to represent this company in your Association, in place of the Gas Company, I beg to say that so long as the Association allows its time to be spent at its meetings by rival patent-right owners, to decry each others wares, I for one cannot afford to come over one thousand miles to furnish an audience for such men. When I was in attendance at the meeting in 1873, I became satisfied that your Association was not to be an Association of Gas Managers—of men actually in charge of gas works—who could meet and compare notes from their own experience, and to confer social benefits upon each other, but rather an association of men who back some pet scheme or other, to sell to gas companies, so I have not been to any meeting since, nor shall I feel called on to pay the amount you say this company owes as dues. But whenever the Association will come right to its legitimate business, and make it an Association of Gas Managers proper, I shall be pleased to contribute to its support, in any way that I may be called upon—financially or otherwise.

You are at liberty to do as you please with this letter, as it represents not only my views, but those of a great many with whom I have come in contact out this way, who would like to belong to a real live Managers Association. Yours truly,

THOMAS BUTTERWORTH.

Chemical and Scientific Repertory.

SHAFTING.—The shaft of the Newburyport silver mine has been carried down 230 feet, without getting through the vein. Twenty-two tons of concentrated ore, netting $94 a ton, were shipped recently, and it is claimed that enough ore is now in sight for six months' work.—*Iron Age.*

RAILWAYS.—The Prussian Government has opened credits for the construction, &c., of railways to the amount of about £24,000,000. Of this amount £5,000,000 is expected to be at once raised by a 4 per cent. loan.—*Jour. Society of Arts.*

PAVEMENTS.—The competition between granite, asphalt, and wood, as materials for paving the City of London, has at length been finally decided in favor of wood, after many experiments and careful consideration. Mr. Haywood, the City Engineer, calculates that a horse can go 132 miles on granite before being exhausted, 191 on asphalt, and 415 on wood.—*Ibid.*

MEASURING DISTANCE BY SOUND.—Major Le Boulanger, of the Belgian Artillery, on seeing the flash or smoke of a gun, by touching the key of a chronograph; and on hearing the sound, touching the key again, determines the distance of the gun within 50 feet, corresponding to about 1-20 second of time. This is of great advantage for coast defence against an attaching fleet, enabling the gunners to determine the distance of an attacking ship.—*The Polytechnic Review.*

BURNING OF COAL DUST.—A correspondent calls our attention to another experiment in connection with the burning of coal dust for fuel, which is of considerable interest. At the Ocean Mill, Newburyport, a fanblower is used in creating a draught. Natural draught, it seems, is used in the experiment now in progress. We have the following particulars: The screenings are generally mixed with about one-sixth part of soft coal in burning dust for fuel. A new furnace is in operation at Whitcomb's planing mill, No. 27 Wareham street, Boston, that burns screenings without a blast, which makes an increase in evaporation of 25 per cent. over the old style. The fire is a surface one, and burns down; it is fed on top with hot air, heated by passing through passages in side walls and back pipes. This utilizes the gases and smoke that have before passed out of the chimney. The mixing of the hot air with these gases makes an immense flame and draft.—*Iron Age.*

DISCOVERY OF MINERALS.—The recent African discoveries have developed the fact that vast mineral wealth underlies the surface of that great continent. Lieutenant Cameron, who has just returned from there, tells of enormous deposits of coal and iron; enough, he says, "to supply the world for untold centuries. A canal of 120 miles in length, connecting the Congo and Zambesi rivers will open up these deposits, and provide communication between the Indian and Atlantic oceans. Already England shows an inclination to take possession of this valuable country, which was disclosed to the world by Lieutenant Cameron's important explorations."—*Exchange.*

STREET DIRECTORIES.—The Street Lamp Committee of the Manchester City Council, at a recent meeting, unanimously authorized the erection in Market-street, by way of experiment, of eight of Messrs. Pearse, Lever, and Co's "Public Street Directories.' These directories are a novelty in their way. The directory consists of a frame, containing either four, six, or eight name-plates, which can be adjusted to the existing street-lamps. Four directories will be placed at equal distances on each side of the street. At the top will be printed the name of the street; and below, the words "Public Street Directory of ——." The name-plates are constructed to slide in the frames, so that they can at any time be corrected without trouble. They will contain:—1. The names of the various firms trading in the street in which they are erected, with the numbers, arranged alphabetically. 2. The name of the various streets and courts leading from the street, with the numbers nearest from which they abut, arranged alphabetically. 3 Information as to the nearest postal and tele graph offices, railway, fire, and police stations, doctors, &c. Each of the directories will accommodate from 300 to 400 names.—*Jour. Society of Arts.*

Gas-Light Intelligence.

United States.

REDUCING THE PRICE OF GAS.—The Brooklyn Gas Company has reduced the price of gas from $2.75 to $2.50 per 1000 feet, and the Metropolitan Gas Company of Atlantic Avenue have reduced their price to $2.50.—*N. Y. Sun.*

KNOXVILLE GAS-LIGHT COMPANY.—At a meeting of the Knoxville Gas-Light Company, held at their office last week, the following Directors were elected for the ensuing year:

H. H. Taylor, R. S. Payne, C. S. Newman. James Comfort, C. Cullen, R. M. McClung, R. B. Swepson.

The Directors subsequently held a meeting and elected the following officers: R. B. Swepson, President; James Somerville, Secretary and Superintendent.

CONVICTED FOR MAKING A CTNNECTION.—In the Municipal Court of Cleveland, Ohio, a man was recently convicted for connecting his gas pipe to the service below the meter, or in other words "bye-passing his meter," and it cost him about $100. Although he had been at it only a few days he made, through his attorneys, a stubborn defence. His name is Ferdinand Weber, and we are told that he claims to have done the same thing in New York city, where he says it is a common thing. If this is so we should think a careful examination would result in a reduction of unaccounted for gas,

A Glass Circle for the Measurement of Angles.

BY LEWIS M. RUTHERFURD.

At the summer meeting of the National Academy of Sciences, in the year 1866, I described the micrometer which I had constructed for the measurement of astronomical photographs. It was capable of measuring angles of position, and also distances in directions at right angles to each other. These last measurements were made by aid of screws arranged after the manner of those of an ordinary slide rest; these screws were constructed with great care and I had good reason to be satisfied with the smallness of their errors.

At the Spring meeting of the Academy, for the year 1870, I explained that I had been obliged to give up the idea of using screws on account of the rapid changes in their errors caused by friction and consequent wear, and I then stated that I intended to discard the screw and the compressed slide, and substitute for them a divided glass scale, to be read by a micrometer microscope, and a gravity slide with one V and one flat slide. This intention I carried out during the year, the new form being first used about the month of March, 1871. It has been constantly used since that time, and continues to give great satisfaction. The success of this divided glass scale confirmed me in a determination of long standing to try the experiment of substituting a glass circle for one of metal in some instrument for the measure of angles of precision.

Two years absence in Europe and other occupations conspired to postpone the execution of this plan until the past winter, during which it has been realized with what seems to me the most promising success. I had in my possession a spectrometer by Bruner of Paris—his small model, similar to the one used by Mascart, and figured in his paper on the measure of wave lengths. This instrument has a good steel center and was furnished with a circle divided on silver reading by means of the verniers to 10″. The diameter of the circle is small, not quite seven inches, and the inability to read smaller angles has always been its weak point. I have substituted for this metallic circle one of glass, about ten inches in diameter, divided by Mr. Stackpole to ten minutes of arc, and read by two micrometer microscopes magnifying seventy-five times; each revolution of the screws being equivalent to one minute, the drums being divided into sixty parts, read to seconds with easy estimate of fractions—each degree line is numbered so as to be visible in the field of the microscope. I was able to furnish to Mr. Stackpole a well tried diamond which has made lines of the greatest delicacy, being much finer as seen in the microscopes than the spider lines,

by means of which the bisections are made. The advantages of this system are obvious, viz., perfection of surface permitting a line of any desired fineness—facility of illumination permitting the extension of the power of the reading microscopes to several hundred times—smallness of dimensions and consequent cheapness and avoidance of almost all the questions of flexure and local effects of temperature.

I am convinced from the ease with which one second is read on my instrument, with microscopes only 4¾ inches long including objectives and eye-pieces, that upon a circle of fifteen inches provided with powerful microscopes, greater precision could be attained in the reading of angles than with the largest metallic circles now in use.

For the purpose of showing the degree of precision attainable, I add two series of bisections of lines on the circle made by myself, and two made by a lady, marked respectively R and M.

R.	R.	M.	M.
7″·5	1″·8	23″·6	11°·
7 ·4	1 ·3	23 ·6	11 ·2
7 ·7	1 ·9	23 ·3	11 ·8
7 ·4	1 ·8	23 ·8	11 ·
7 ·3	1 ·8	24 ·5	10 ·9
7 ·6	1 ·8	23 ·9	11 ·5
7 ·7	1 ·9	23 ·7	11 ·5
7 ·4	2 ·	24 ·	11 ·5
7 ·6	2 ·3	23 ·9	11 ·
7 ·8	2 ·3	24 ·3	11 ·4
Mean, 7″ 54	1″·89	23″·86	11″·28

It will be readily seen that the probable error of any single reading in any one of these series is considerably less than half a second, while the probable error of the mean of any series is a much smaller fraction.—*Amer. Jour. of Science and Arts.*

Gas Burners.—A Word of Advice to Consumers.

Editors Liberal Democrat: The many questions asked at various times, with reference to different kinds of gas burners, and the most economical condition under which gas can be used as a means for producing artificial light, have prompted the following, for the benefit of those of your readers who use it:

About twice or three times a year canvassers come around trying to deceive the public with some kind of patent gas burner, in which it is claimed that all the gas is thoroughly consumed, a great increase in illuminating power attained, and a saving of twenty-five to fifty per cent., as the case may be, caused by its use. Many burners, that have no superior merit whatever, are sold at prices varying from 30 cents to $1.50 each, in this way.

Invariably they are fixed aperture, but more commonly called check burners. To illustrate the working of this principle of burner, let us suppose one of them to be adjusted to consume five feet of gas per hour, under pressure of 25-10ths (gas pressure is always represented in inches of water), which is the maximum street pressure of this city, and let it be reduced to 9-10ths pressure, which not unfrequently happens, and the burner will deliver only about half the first named quantity, and since it is well known that the intensity of flame increases with, but in greater ratio than, the quantity of gas used, it will develope probably one fourth of the original light, which will be altogether insufficient for the requirements of the consumer, and with most of these patent burners he has positively no remedy left, but a resort to lamps or candles, since he cannot change the adjustment without the aid of proper tools, notwithstanding that plenty of gas enters his premises. Now since all fixed orifice burners are exactly alike in principle and in action, though many of them differ materially in their mechanical construction, the discharge always varying, with every change of pressure in the street mains, which sometimes is very considerable during the evening hours of burning, it will be easily seen that the high priced burner of this class is no more economical than the low priced one, and that either kind will accomplish no more than can be obtained by packing a little cotton wool inside o a common brass or iron pillar, and at no greater expense to the consumer, than the trouble of unscrewing the pillar or burner from the fixture, and screwing it back again. However cheap the first cost of this class of burners, they are expensive in the end, and will waste gas to the amount of many times their cost in a short time. A good gas burner is of the highest importance to the consumer, because the work that shows on the index of his meter is all done here. The perfection of the combustion depends altogether upon the burner, and if not properly arranged, will permit some of the gas, which is already recorded on the face of the meter, to pass off as smoke and soot; or the admission of too much air will cause great heat instead of producing light, as may be seen in an exaggerated degree in an atmospheric or Bunsen burner. Every oil lamp or candle is simply a small arrangement for the manufacture and consumption of gas. In a common candle the tallow is drawn to the burning wick, by capillary attraction, and quickly converted into gas and burned. The hydrogen in the gas is the heat giving constituent, and the carbon the light-producing element, and the longer the latter is held in an incandescent state in the flame, the more perfect will be the combustion; and the burner which has the best adjusted supply of atmospheric air to the flame will do this the best, and develops the greatest light from the least quantity of gas. In fact, the chief means of obtaining the maximum illuminating power from gas is, to insure an exactly adequate supply of air to the gas flame.

The greater the velocity with which gas issues from a burner, the more air is the flame brought in contact with, and it is apprehended that too much air is more frequently a source of waste to the consumer, than an insufficient supply. The destructive effect of excessive pressure is at once apparent in the paleness of the flame, as compared with the light obtained from the same quantity of gas, burnt under proper regulation, and in this connection it may be well to say, that the consumer cannot be too thoroughly impressed with the urgent necessity of burning his gas under low pressure, if he would secure to himself good results. With an Argand burner the quantity of air is regulated by the glass chimney surrounding it, and the best burning point immediately precedes the smoking point, while in the case of flat flame burners the supply wholly depends upon the pressure at which the gas issues from the tip, and should always be the lowest possible point that will develop a properly shaped flame. When the latter class of burners are employed to consume common coal gas, the pressure should be about from two to three-tenths at the burning point, varying a little with the size of the tip used, and that *pressure should remain constant.* And it is important to observe that generally these essential conditions can only be complied with by the use of a good self-acting governor, either at the meter or in connection with the burner, the latter plan being perhaps the most desirable.

With a moderate rate of consumption, properly regulated flat flame burners are by far the most economical and least expensive to the consumer, as well as least troublesome, since they require no chimney, while with a larger rate of burning the different adaptations of the Argand are generally considered the best. Much more might be said than is possible in one brief sketch, on the subject of gas burners, but if the facts already presented will assist consumers in selecting good burners and enable them to use the gas they buy and pay for to better advantage, the object of this article will have been accomplished,

GEORGE MCMILLAN.

—*Liberal Democrat, La Crosse, Wis.*

Generating Steam with Coal Dust.

The utilization of coal dust being a matter of considerable importance to all consumers of fuel, much interest attaches to the subjoined comparative terts with large and small coal. In the first experiment, that made on April 4, the fuel used consisted entirely of screenings and coal dust reduced to proper fineness, the furnace being prepared and fuel injected with the apparatus invented and patented by G. K. Stevenson, whilst in that of April 7, the best selected screened Chile coals (bituminous) were employed. Boiler, single through inside, with double return on t side flues; length of boiler, 24 feet: diameter, 5 feet 1 inches; diameter of flue, 3 feet 3½ inches; engine, 10 inches diameter cylinder, 25 inch stroke:

	April 4.	April 7.
Date of trial		
Duration of trials	4 hours.	4 hours.
Lbs. of pulverized fuel each trial	240	...
Lbs. of best large screened coal	...	488
Average pressure in boilers —lbs	23.7	22.25
Average pressure in cylinder, per diagrams	14.25	11.55
Revolutions per minute	53.5	57.
Pressure in boiler at commencement	24.	21.
Indicated horse power	7.56	6.63
Lbs. of coal per horse power per hour	7.32	17.11
Cubic feet of water by steam through engine, as per diagram	32.03	31.57
Cubic feet evaporated per zone, boiler without feed during time	...	48.5
Lbs. of water per lb. coal D,	8.54	4.14
Lbs. of water per lb. per zone	...	6.36
Lbs. of coal per cubic feet of water, D	7.5	15.46
Lbs. of coal per cubic feet water per zone	...	10.06

—*Coal Trade Journal.*

Analysing the Air.

At a recent meeting of the Glasgow Police Board reference was made to a work published some years since by Dr. Angus Smith recording certain investigations made by himself relative to the purity of the atmosphere in large towns. The state of the air in different parts of this city, taken in connection with the high death rate, was properly considered by the Board sufficiently alarming as to lead them to direct the Medical Officer of Health, Dr. Russell, to institute a series of experiments so as to obtain, if possible' reliable data on this important subject.

Mr. E. M. Dickson, a chemist who has earned some reputation as being skilled in such matters, has been associated with Dr. Russell in making these experiments, but, so far as they have been carried out, a considerable amount of difficulty has been encountered in collecting the air, so as to admit of satisfactory analysis os the impurities it contained. The process employed in recent experiments may be described as air-washing by muscular power. The air was collected in two glass globes, of similar size to those of an ordinary gasalier, and connected by a glass tube. One of the globes was abaut three-fourths filled with air, the other contained a small quantity of water. The man who had charge of these vessels was stationed in the particular part of the city where it was desired to collect a specimen of the air. When the water was allowed to flow gradually from one receptacle to the other, air filled up the vacuum, and when the water was passed back again the air, in passing through the liquid, left behind its impurities. After the lapse of a day or two, a fresh supply of water was introduced, that which was polluted being carefully stored for analysis.

These experiment were continued for about a fortnight, but, unfortunately, when the analyses were commenced it was found that a sufficient quantity of air had not come in contact with the water to afford a basis for exhaustive chemical tests. Mr. Dickson not only reported this matter to the Police Board, but, as the result of a communication with a French chemist, a plan has been devised which it is hoped will clear up the difficulty. In lieu of the men hitherto employed to collect the air it is proposed to apply mechanical power, by which a larger volume will be obtained for submitting to the desired analysis. Mr. Foulis, engineer to the gas corporation, is employed in preparing a special vessel into which air will be drawn through a small glass rose, similar in shape to that on the spout of an ordinary watering can. The new process, moreover, will only need a smaller quantity of water, and it is hoped by this means that the impurities will be deposited in such quantities that their relative proportions will be much more readily ascertained.—*Iron.*

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SATURDAY, SEPTEMBER 16, 1876.

An Oil Pipe Three Hundred Miles Long

The Pennsylvania Transportation Company has been chartered by the State of Pennsylvania for the purpose of transporting oil from the oil regions to the principal Atlantic seaboard cities. The plan proposed is to run the oil through a four-inch pipe laid on the surface; the forcing power will be nine hundred pounds to the square inch; there are to be stations at distances of fifteen miles, at each of which an engine of a hundred horse power will be erected to work a pump to continue the flow from point to point. The company having decided upon the construction of the work, the president sought the services of General Harman Haupt, of Hoosac tunnel fame, and who, during the war, was chief of the Bureau of Military Railroads, who pronounced the scheme, after a thorough examination, to be entirely practicable, and he is now acting as engineer-in-chief.

In view of the enormous product of oil in this country—30,000 barrels per day—and the rank it now holds among the leading articles of export, coupled with the exorbitant charges for railroad carriage from the wells to the seaboard, by the completion of the enterprise and its successful operation, a complete revolution will be accomplished in the handling of this article.

The estimated cost of the entire work, including fixtures, etc., is one and a quarter million dollars.

The Pennsylvania Company is the parent company, but there is also the Baltimore Transportation Company, chartered by the State of Maryland, and some five other companies are expecting to unite. The first objective point or terminus will be Baltimore, as being the most feasible and direct route for the pipes Following which other termini will be established in Philadelphia, New York, etc. The pipes being laid on the surfrce and there being no obstacle in the way of forcing the oil to any height, the line will literally be in air line, and the distance from the oil regions to Baltimore is three hundred miles. The oil will be distributed from the pipes into immense reservoirs with refining establishments adjacent.

The feasibility of this enterprise, so far as the passage of the oil through the pipes is concerned, has been fully established by the present system in operation in the oil regions, where the aggregate length of the pipes conveying the oil from the several wells to the reservoirs is nearly two hundred and fifty miles.—*Polytechnic Review, from Boston Traveler.*

Erythrogen and Some of its Compounds.

BY LEWIS THOMPSON.

When we look at the vast extent of our gas-making industry, and the number of persons interested in keeping up an artificial cry about the "sulphur in gas," we may well wonder that so little has yet been done to remove the exaggerated defect. But this display of inventive poverty is not altogether without its value, for it teaches us, beyond the possibility of doubt, that Governmental interference with any manufacturing industry is not a rapid road to improvement.

About twenty-nine years ago I first became aware of the fact that such articles as liquor ammonia and carbonate of ammonia, when made direct from gas-liquor, always contained more or less of a peculiar red substance, which contaminated the ammoniacal products, and rendered them unfit for use in silk dyeing and some other arts; and a carefull examination convinced me that this red matter was not sulphocyanide of iron, but had some mysterious connection with bisulphuret of carbon. I have often separated this red matter from gas liquor, and also from gas-lime refuse, and both shown and given it to several of my friends, but it has always been so mixed with other impurities that no decisive opinion could be formed regarding it, except the mysterious connection above alluded to. The mystery, however, appears to admit of solution if we suppose the bisulphuret of carbon to be a halogen body like cyanogen, and therefore capable of uniting directly with metals, a supposition which I have carried out into practice by combining it to potassium, with which it forms a compound remarkable for the blood-red color of its solutions in water and alcohol, and therefore I propose to give the name Erythrogen (from "Erythros," red) to the bisulphuret of carbon in its combinations, and Hydro-Erythric Acid to the acid set free from the solution of the erythride of potassium by an acid.

Not to trouble your readers with any superfluous remarks, I will describe in as few words as possible the mode of making the erythride of potassium, from which the hydro-erythric acid and other compounds may be produced by the usual chemical processes.

To make erythride of potassium, we must begin by making an amalgam of potassium, consisting of about 1 part by weight of potassium and 150 of mercury, which is easily done by fusing them together under naphtha.

When cold pour off the naphtha, and having wiped the surface of the amalgam with a dry cloth, transfer it as quickly as possible to a dry stoppered bottle, and add to it a quantity of bisulphuret of carbon equal to about three times the weight of the potassium employed; then shake the whole well together until the mixture becomes solid, when it must be set aside for a few hours to cool and complete the combination. After this, the surplus bisulphuret of carbon is to be driven off by a current of air, and the erythride of potasium separated from the mercury by water and filtration in the usual way. But it is worthy of notice that a part of the mercury, under the influence of the potassium, is converted into erythride of mercury at the same time, and this holds out a hope that such metals as lead and antimony, in a very minute state of subdivision may be useful in purifying coal gas from bisulphuret of carbon; and, in fact, I am now actuall trying the pyrophoric mixture of lead and charcoal, formed by heating the tartrate of lead, and it seems to promise well. When the hydro-erythric acid is thrown down by acids from the solution of erythride of potassium, much of it is decomposed in carbonic acid and sulphuretted hydrogen, except at a very low temperature; but in either case it forms a fixed, chocolate-red, granular powder, most remarkably like selenium.—*Chemical News.*

The Suez Canal—The receipts of the Suez Canal show a considerable increase each month. In January last £110,400 were taken on 142 vessels passing through. The following is the number of vessel which have passed through the canal since it was opened:—1869, 10 vessels; 1870, 486 vessels; 1871, 765 vessels; 1872, 1,082 vessels; 1873, 1,173 vessels; 1874, 1,264 vessels; 1875, 1,494 vessels.—*Journal Society of Arts.*

Price of Gas.

The following prices are *official*, having been furnished to the AMERICAN GAS LIGHT JOURNAL by the officers of the various Gas Companies.

Albany (Peoples) N. Y.	$2.75	
Annapolis, Md.	3.40	
Atchison, Kansas.	4.50	
Austin, Texas.	6.00	
Allegheny City, Pa.	1.80	20 p. ct. off prompt pay
Albany, N. Y.	2.75	
Ashland, Ohio	3.50	Street lamps 4½ hours 17 nights per month $15 per annum.
Augusta, Ga.	4.00	Net.
Anderson, Ind.	3.50	Crude petroleum.
Ashtabula, Ohio	2.00	Wren's process; $10 for 80 candle gas.
Auburn, N Y.	3.50	5 p c off prompt pay.
Allentown, Pa.	2.50	$18 per an street lamps Meter rent 10 cents per month.
Ashland, Pa.	10.00	70 candle gas, 10 p c off prompt pay. Paton's process.
Brooklyn, B'klyn.	2.50	
Brooklyn, Citizens.	2.25	
" Nassau.	2.75	
" Metropol'an	2.50	
" Peoples.	2.75	
" W'msburgh	2.75	
Brookton, Mass.	3.80	
Batavia, N: Y.	3.00	
Bridgton, N. J.	3.50	
Bangor, Me.	3.00	
Boonville, Mo.	4 50	
Brownsville, Tenn.	4.50	
Belfast, Maine.	4.00	10 p. c. off bills over $10; 5 p. c. off bills under $10.
Brockville, Ontario.	3.75	
Bloomfield, N. J.	3.75	
Belleville, Ill.	3.50	
Bellaire, Ohio.	2.85	5 p ct. off prompt pay.
Barnesville, Ohio.	3.00	5 p ct. off prompt pay. Street lamps $17.50 per ann. Burn till 12 P. M. on moonless nights.
Boston, Mass.	2.25	
Bath, Maine.	4.00	12½ p c off prompt pay.
Bayonne City, N. J.	4.00	Net.
Binghampton, N. Y.	4.00	10 p c off prompt pay on bills for 1000 per month.
Buffalo G L Co., N Y.	2.50	10 p c off prompt pay.
Buffalo Mutual, N Y.	2.50	10 p c off prompt pay.
Buffalo Citizens, N Y.	2.50	10 p c off prompt pay.
Bloomsburg, Pa.	10.00	70 candle gas, 10 p c off prompt pay. Paton's process.
Burlington, Iowa.	3.75	15 p c off bills of $100, and 2g p c over $200. Street lamps $25.22 each, per annum.
Cleveland, Peoples, O	2.00	
Cumberland, Md.	3.00	
Charleston, W. Va.	4.00	25 p. ct. off prompt pay Meter rent 25, 30, and 50 cents. per m. for 3, 5 and 10 light.
Cincinnati, Ohio.	2.25	
Columbia, Mo.	4.50	
Carondolet, South St. Louis, Mo.	3.00	5 p. ct. off prompt pay,
Chattanooga, Tenn.	3.00	
Cold Water, Mich.	3.25	
Chicago, Ill.	2.50	
Columbia, Pa.	2.85	Lowe process.
Charlottesville, Va.	2.50	Meter rent 20 cents.
Cedar Rapids, Iowa.	4.50	50 cts p M. off prompt pay.
Cairo, Ill.	3.75	50 cts added if not paid by the 5th.
Cortland, N. Y.	4.00	25 cts p M. off prompt pay.
Cairo, Ill.	3.75	50 cents per month off prompt pay. For 20,000 feet a month $2.50.
Chillicothe, Ohio.	3.00	
Camden, N. J.	3.16	5 p c off prompt pay; 10 p c off for 100,000 per year.

Carson City, Nevada...	8.00	Gas from wood and Cannel coal.
Cadiz, Ohio.....	3.50	10 p c off on 500 feet or less; 50 cts per M. on from 500 to 2000; 20 p c off on 2000 and upwards.
Charlestown, Mass.....	2.75	
Derby, Conn.....	3.60	10 p. c. off prompt pay, and 50 cts per M. on excess of 5000 ft. per month.
Decatur, Ill.....	3.50	50 cts. per M. added, if not paid by 10th.
Danbury, Conn.....	4.28	For less than 5000 per month.
" "	3.85	For over 5000 per m th
Dover, Del.....	3.60	
Dunkirk, N Y.....	2.50	Street lamps till 12, moonless nights $25 per annum.
Defiance, Ohio.....	10.00	70 candle gas, 20 p c off prompt pay. Patton's process.
Delaware, Ohio.....	3.00	No charge for meter.
East Boston, Mass.....	3.00	
East St. Louis, Ill.....	3.50	5 p. c. off prompt pay.
Evansville, Ind.....	3.00	City lamps $30.
Erie, Pa.....	3.00	City lamps $28 p. an.
Elkhart, Ind.....	3.50	
East Newark, N. J.....	4 00	
Eastchester, N. Y.....	3.50	
Elizabethtown, N. J...	3.00	
East N Y (Union) L I.	3.00	
Eastport, Me.....	4.00	
Fredericksburg, Va.....	3.40	
Flint, Mich.....	3.50	
Franklin, Pa.....	3.00	
Fall River, Mass.....	3.00	
Freeport, Ill.....	3.80	
Fort Scott, Kansas....	4.50	
Flatbush, L. I.....	3.50	
Fredonia, N. Y.....	3.00	Street lamps $25 per annum; burn fill 12 P. M.
Guelph, Ontario.....	3,50	
Geneva, N, Y.....	2.50	5 p. c. off prompt pay. Wood and oil gas.
Greensboro, N. C.....	4.00	
Galena, Ill.....	4.50	Meter rent 25 cts. per month.
" "	4.00	After September 1st.
Grand Rapiids, Mch..	2.80	For less than 1000 feet per month.
" " "	2.50	For over 1000 eet per month. 10 per ct discount on 300,000 ft annually
Gloucester, N. J.....	3.15	5 p c off prompt pay.
Greenwich, Conn.....	2.40	Wren's process
Goshen, Ind.....	10.00	70 candle gas, 20 p c off prompt pay. Patton's process.
Galesburgh, Ill.....	3.50	10 p c off prompt pay.
Huntsville, Ala.....	3.50	
Hempstead, L. I.....	4.00	
Huntingdon, Pa.....	3.80	10 per ct. off prompt pay.
Hagerstown, Md.....	3.75	
Hamilton, Ohio.....	4.00	
Hillsdale, Mich.....	3.50	
Holyoke, Mass.....	3.01	
Hartford, Conn.....	2.75	
Hornellsville, N. Y....	3.50	50 cents per 1000 off prompt pay.
Honesdal e, Pa.....	4.00	12½ cents meter rent per month.
Hannibal, Mo.....	3.00	No meter rent.
Ithaca, N. Y.....	4.00	5 p. c. off prompt pay.
Indianapolis, Ind.....	2 50	
Indiana, Pa.....	3.00	10 p. c. off prom pay Meter rent 50 cents per month.
Jersey City, N. J.....	2.75	
Joliet, Ill.....	3.50	
Jacksonville, Ill.....	4.00	12½ p.c. off prompt pay.
Jefferson City, New Orleans, La.....	4.00	
Johnstown, N Y.....	3.50	
Knoxville, Tenn.....	3.00	Meter rent 15 cents.
Lyons, N. Y.....	4.00	
Lima, Ohio.....	3.80	
Lynchburgh, Va.....	3.00	5 p. ct. added to bills not paid in 5 days.
Louisiana, Mo.....	4.50	
La Crosse, Wis.....	4.50	50 cents per M. off prompt pay.
Lancaster, Pa.....	3.00	
Louisville, Ky.....	2.70	5 p. c. off prompt pay.
La Porte, Ind.....	3.50	Wood and oil gas.
Lowell, Mass.....	2.50	25 cents per 1000 off prompt pay.
Lafayette, Ind.....	2.75	
Lexington, Mass.....	2-40	Wren's process.
Los Angelos, Cal.....	6.00	
Lockport, N Y.....	3.20	Less 20 p c per M. if paid within 30 days.
Millville, N. J.....	3.12	
Milford, Del.....	3-50	
Marquette, Mich.....	3.50	
Morris, Ill.....	2.00	For 15 candle power, or $10 per M. coal gas meter measure (Petroleum Gas—Wren's patent).
Meriden, Conn.....	3.93	
Marietta, Ohio.....	3.50	20 cts. per M. off if paid by 6th. Consumers over 3000 ft. 30 cts. additional discount.
Marshalltown, Iowa...	4.50	50 cts p M. off prompt pay.
Meadville, Pa.....	3.50	25 cts p M. off prompt pay.
" '	2.50	For over 10,000 ft. per month,
Madison, Ind.....	3.75	25 p c off if paid in five days: 25 to 40 cents per month meter rent.
Monroe, Mich.....	3.50	5 per ct off prompt pay
Malone, N. Y.....	4.50	
Middletown, Conn....	3.56	Net.
Mount Sterling, Ky....	4.50	
Monongahela, Pa.....	2.75	Under 5000 feet m'th $2 75 per M.; over 5000 feet per month $2.50 per M.
Minneapolis, Minn....	5.00	10 p c off prompt pay.
Mahanoy City, Pa.....	10.00	70 candle; 20 p c off prompt pay. Patton's process
Morristown, Pa.....	3.00	18 candle coal, an
New York, New York.	2.50	
" " Harlem....	2.75	
" " Manhattan	2.50	
" " Mutual.....	2.50	
" " Mropolitan	2.50	
" " Municipal.	2.50	Water Gas.
Nashville, Tenn.....	2.85	
Newark, Citizens, N.J.	2.85	
Norfolk, Va.....	3.10	
New Brunswick, N. J.	2.70	
Newton, N. J.....	4.00	
North Attleboro, Mass.	3.50	
New Britain, Conn.....	3.70	
New Haven, Conn.....	2.75	
Nantucket, Mass.....	3.00	Meter rent 15 cts. p. m.
Newark, N. J.....	2.85	
Niagara Falls, N. Y....	3.50	20 cts p M. off prompt pay.
Norwalk, Conn. ..	4.00	12½ p ct off prompt pay.
New Albany, Ind.....	3.00	
New City, Montreal...	2.50	Street lamps, $22 p a
Oswego N. Y.....	3.15	5 p. c. off prompt pay.
Ottawa,, Ill.....	4.00	12½ p. c. off promptpay
Omaha, Nebraska.....	5.00	
P'keepsie, Citizens....	2.70	Gwynne Harris process
Paterson, N. J.....	3.80	10 p c. off prompt pay, and in addition 5 p.c. on bills of $200; 10 p. c. on bills of $1000
Portchester, N. Y.....	3.50	
Pittsfield, Mass.....	3.50	5 p. c. off prompt pay, and 10 p. c. off on bills of $350 per an
Portland, Me.....	3.00	
Paris, Ky.....	4.50	Meter rent 25 cts. p m.
Portsmouth, N. H.....	3.22	
Pittsburgh, Pa.....	1.00	
Philadelphia, Pa.....	2.15	
Painesville, Ohio.....	3.50	
Pawtucket, R. I.....	2.80	5 p c allowed on bills of $500, and 10 p c on bills of $1500 for six months.
Providence, R. I.....	2.25	
Pottsville, Pa.....	3.50	10 p ct off promp pay,
Plainfield. N. J.....	3.50	5 p ct off for less than 5000 a month. 10 per cent more than 5000 a month.
Peoria, Ill.....	3.50	
Paducah, Ky.....	4.00	10 p c off prompt pay.
Plymouth, Pa.....	10.00	70 candle. Patton's process.
Pottstown, Pa.....	3.20	Public lamps till 11 P. M., 18 nights per month $20 per lamp.
Poughkeepsie, N Y....	2.60	10 p c off prompt pay
Port Huron, Mich.....	3.50	
Quincy, Citizens, Mass.	5.00	
Quincy, Ill.....	3.50	
Quebec, Ont.....	2.40	
Rome, N. Y.....	3.60	
Rochester, N. Y.....	3.00	
" Citizens...	3.00	
Rondout, N Y.....	3.60	
Rockford, Ill.....	4.00	5 p c off prompt pay; 10 to 25 p c off on bills for 500 to 25 M, feet per month.
Rockford, Ill.....	3.50	For monthly bills under 1000.
" "	3.00	For ditto over 1000.
Richmond, Ind.....	3.00	50 cents added if not paid by 20th.
Syracuse, N. Y.....	2.75	
Springfield, Ill.....	3.25	$25 for city lamps.
St. Joseph, Mo.....	4.00	12½ p. ct. off on bills over $100 p. month.
St. Albans, Vt.....	5.00	10 p. c. off prompt pay, and in addition 5 p. c. off bills from $50 to $100 per month; 10 per. ct. off bills over $100.
Sandusky, Ohio.	3.00	
Saratoga, N. Y.....	5.00	20 p. c. off prompt pay, Nov. 1st to May 1st. 10 p. c. rest of year.
San Antonio, Texas....	7.00	10 per ct off from 10 to 20,000 per month 20 p ct off from 20,000 and upwards.
St. Charles, Mo.....	4.50	
Sidney, Ohio.....	3.25	
Steubenville, Ohio.....	2.50	
Sherman, Texas.....	5.00	5, 10, 15 and 20 p. c. off, according to quantity.
Salem, Oregon.....	7.00	October last reduced from $8.
Salem, Ohio.....	2.75	Meter rent 12½ cts if 300 feet is not used monthly
Sedalia, Mo.....	3.50	
Sharon, Pa.....	3.15	5 per ct off on less than 5000 feet per month. 10 p ct from 5 to 15 M. 15 p ct from 15 to 20 M. 20 per ct over 40 M.
Shreveport, La.....	5.00	
Shelbyville, Ind.....	2.00	Wren's process; $10 for 80 candle gas.
Shenandoah, Pa.....	10·00	70 candle. Patton's process.
Shamokin. Pa.....	10.00	70 candle. Patton s process.
Sunbury, Pa.....	10.00	70 candle. Patton's process.
Stockton, Cal.....	4;50	
Stamford, Conn.....	3.50	5 p c off on 15,000 per month; 10 p c off on 25,000 p month; 15 p c off on 35,000 per month. Meter rent 12½ cts and upwerds.
Tiffin, Ohio.....	3.00	
Titusville, Pa.....	3.00	
Tidioute, Pa.....	2.00	Wren's process.
Vicksburgh, Miss.....	4.50	
Wilkesbarre, Pa.....	3 50	10 p. c. off prompt pay.
Worcester, Mass.....	3.00	5 p. c. off on $500, and 10 p. c. off on $1000 in six months.
Westfield, N. Y.....	4.00	10 p. c. off prompt pay.
Washington, D. C.....	2.25	
Watertown, N. Y.....	4.50	10 p. c. off prompt pay.
Wheeling, West Va....	2.25	10 p ct off prompt pay.
Washington, Pa.....	2.50	
Woburn, Mass.....	3.00	
Waterbury, Conn.....	3.50	5 p c off on biils of $50 10 p c off on bills of $100. 5 p c added if not paid by 10th.
York, Pa.....	3.00	Meter rent 12½ cents.
Youngstown, Ohio.....	2.50	10 p. c. off on bills of $50 per month.
Youngstown, Ohio....	2.50	For monthly bills under 3000.
" "	2.25	From 3000 to 5000.
" "	2.00	From 5000.
Yonkers, N Y.....	2.00	Net.
Waterbury, Conn.....	3.00	5 p c off on bills of $50, 10 p c off on bills of $100; 10 p c added if not paid by 10th.
Washington, C H., O.	1.20	Wren's process; $6 for 80 candle gas.
Wilmington, Del.....	2.50	Street lamps 3,650 hrs per year, $31.50 per lamp.
Zanesville, Ohio.....	2.70	10 p. c. off on bills o $25 per month; city lamps $23.

Gas Stocks.

Quotations by W. B. Scott & Co., Bankers,

24 Pine Street, New York City.

September 16, 1876.

☞ All communications will receive particular attention

Gas. Co.'s of N. Y. City.

	Capital.	Par.	Bid.	Asked.
Harlem	$1,850,000	50	115	120
Manhattan	4,000,000	50	240	...
Metropolitan	2,500,000	100	145	150
" Scrip	$1,000.000	..	102	—
" Bonds	500.000	1000	104	—
Mutual	5,000,000	100	109	111½
" Bonds, gold.	900,000	1000	105	—
New York	4,000,000	100	135	140
Jamaica, L. I.	25,000	100	...	—
Jacksonville, Ill.	120,000	50	82	...
Lewistown, Maine	400,000	100	50	85
Lima, Ohio	60,000	100	10	...
Bonds	30,000		90	
Laclede, St Louis Mo	1,200,000	100	100	110
Peoples, Jersey City		...	125	135
Peoples of Albany	650,000	100	—	20
" Bonds	350,000	1000	—	—
Peoples of Baltimore		25	99	100
" Bonds			106	—
Perth Amboy		25	—	95
Rochester, N. Y.		100	50	60
Richmond Co., S. I.	300,000	...	100	105
Woonsocket, R. I.	150,000	100	100	...
Halifax N. S.	400,000	40	148	150
Hamilton, Ontario	150,000	40	112½	
San Francisco Gas-Co., S. Fr'isco Cal.			99	100
St. Louis, Missouri	600,000	50	—	100
Stillwater, Minn	50,000	50	—	26
Suburban, W'stch'str	390,000	50	—	100
Saugerties, N. Y.	15,000	100	110	115
Troy, Citizens	600,000	100	—	100
Central, Westchester	466,000	50	100	105

Gas Co.'s of Brooklyn.

Brooklyn	2,000,000	25	190	195
Citizens	1,200,000	20	85	87
" Scrip	320,000	1000	95	100
Peoples	1,000,000	10	50	55
" Bonds	$ 325,000	...	—	95
" Scrip	300,000	...	85	—
Metropolitan	1,000,000	100	70	78
Nassau	1,000,000	25	75	80
" Ctfs.	700,000	1000	96	98
Williamsburgh	1,000,000	50	125	130
" Scrip		...	100	103

Out of Town Gas Companies.

Bath, Maine	70,000	100		
Buffalo Mutual, N. Y	750,000	100	—	80
" Bonds	200,000	1000	—	90
Baltimore, Md.	2,000,000	100	150	170
" Ctfs., gold	1,000,000		105	—
Bayonne, N. J.		100		90
Brockport, N. Y.	25,000	100	...	80
Citizens, Newark	918,000	50	90	95
" " Ctfs.	53,000	—	—	—
" " Bds.	124,000	—	—	—
Derby of Conn.	160,000	100	60	80
East Boston, Mass.		25	132	—
Fort Wayne, Ind.		100	...	—
Hannibal, Mo.	100,000	100	95	100
Hartford, Conn.	700,000	25	152	—
Hempstead, L.	25,000	100	...	—
Jersey City	386,000	20	160	—

TO GAS COMPANIES.

FOR SALE, IN LOTS TO SUIT.

TWO HOLDERS—one with Iron Columns and Girders.

HYDRAULIC (4 inch) STAND PIPES, MOUTH PIECES and Covers for two benches of Threes.

Three IRON RETORTS—Condensers, Washer, and Washer Tank.

Three Round (4 feet) PURIFIERS and Covers, with Center Seal and connecting Station Meter and several Dry Meters.

Apply at the office of this Journal. 423

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A GAS WORKS OF ANY CAPACITY, FROM 1,000 TO 10,000 feet Coal Gas per day, by a practical gas maker Parties having such to lease will please send particulars to

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412-2t 13 Bassett St., Providence, R. I.

GAS COMPANIES, CITY GOVERNMENTS. MEN OF SCIENCE,

AND THOSE INTERESTED IN

Lighting Streets, Hotels, Churches, Bridges, Parks, Public Buildings, Etc.,

will find it to their interest to examine the greatest, and we might say the only improvement in Street Lamps since the Pantheon was built. Some trifling changes have been made in the form of Street Lamps, which has improved their appearance, or some more convenient method of fastening a door or hanging a lamp has been invented. But up to this time no improvement in its illuminating capacity or general utility has been made. We now have an improvement not merely in its appearance, but in its essential elements of value, illuminating power, economy, and usefulness, and we solicit the most critical examination of men of scientific knowledge, as well as all who are interested in obtaining the most economical, efficient, and beautiful Street Lamps ever produced, we challenge the world to produce its equal.

It is DYOTT'S PATENT CHAMPION STREET LAMP which we are repared to demonstrate, possessing the following advantages over every other Lamp: First. It will give *double the light* of any other Lamp with the same quantity of gas consumed in it. Second. It will cost 75 per cent. less per annum than others to keep it sound and in good repair. Third. it can be cleaned and kept as handsome as when new, with half the labor required by others. Fourth. It is the handsomest, the most efficient, the most durable, and the cheapest Lamp in existence. It is screwed, bolted or riveted together, and not a particle of tin or solder is used in its construction. It has been selected and purchased by the U. S Patent Office and the U. S. Post Office. Four of our beautiful five-light Clusters now light the entrances to tae U. S. Patent Office. Six five-light Clusters and six of our Ornamental Lamps light the U. S. Post Office at Washington city. Four of our five-light Clusters have for the past two years lighted the entrance to the Baltimore & Potomac depot at Washington, D. C. Our champion Lamps adorn and light hundreds of the handsomest and most costly buildings in this and other countries.

They are extensively used in over 200 cities, and are largely in Canada, Russia, Barbadoes, South America and Australia. They have taken the first Premiums and highest award of every exhibition at which they have been presented. They are manufactured in the largest variety of Designs for single Posts, Brackets, Hanging and in Clusters of two, three, four, five, six and thirteen Lamps. The entrances to the main building of the Centennial Exhibition are lighted with 272 of our Patent Champion Lamps and Brackets of special design. We refer with pride to them. Our Lamps were purchased by the Building Committee, and are not to be taken back *as all others are* at the close of the exhibition.

We will send illustrated cuts, drawings and circulars, and will furnish designs for special purposes of Posts, Brackets and Lamps when written or called for and will take pleasure in answering any inquiries that may be made.

M. B. DYOTT,

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MANHATTAN LIME HURDLES.

We claim these Gas Screens to be superior to anything heretofore used for the purpose of supporting heavy moist, or light layers of lime in the purifiers of gas works. These Screens are so constructed that they will not sag, *and must not be confounded with light split rattan Screens which have been discarded on this account.*

Can be furnished at a low price. A sample sent upon application.

☞ Sample layers of these Screens may be seen in the department allotted by the Society of Civil Engineers, at Philadelphia, to exhibitors of Models of Gas Works, etc., which you are invited to examine. Orders solicited and satisfaction guaranteed.

GEORGE W. DAY, Agent,

414-6t Office 59 Washington, St,. Haverhill, Mass.

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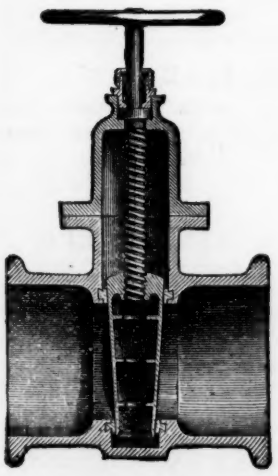

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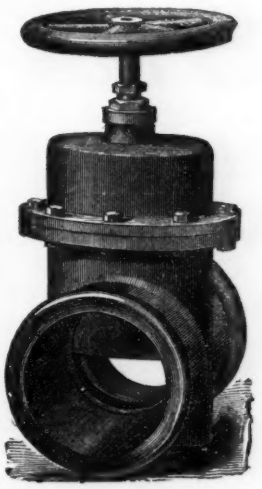

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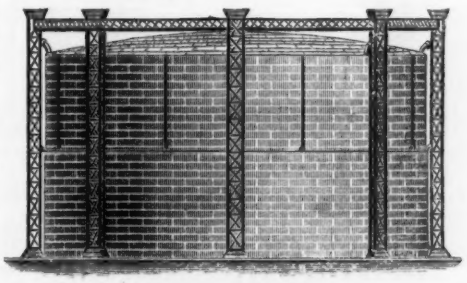

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This process has been fully tested nearly 50,000,000 cubic feet of Gas having been made under it, and fully demonstrating the fact that it is the greatest improvement ever made in the manufacture of Gas, either for Lighting or Heating purposes. With half a ton of Anthracite Coal 150,000 cubic feet of Gas per day is made from three benches, and the labor is so small that one man can attend three or four benches.

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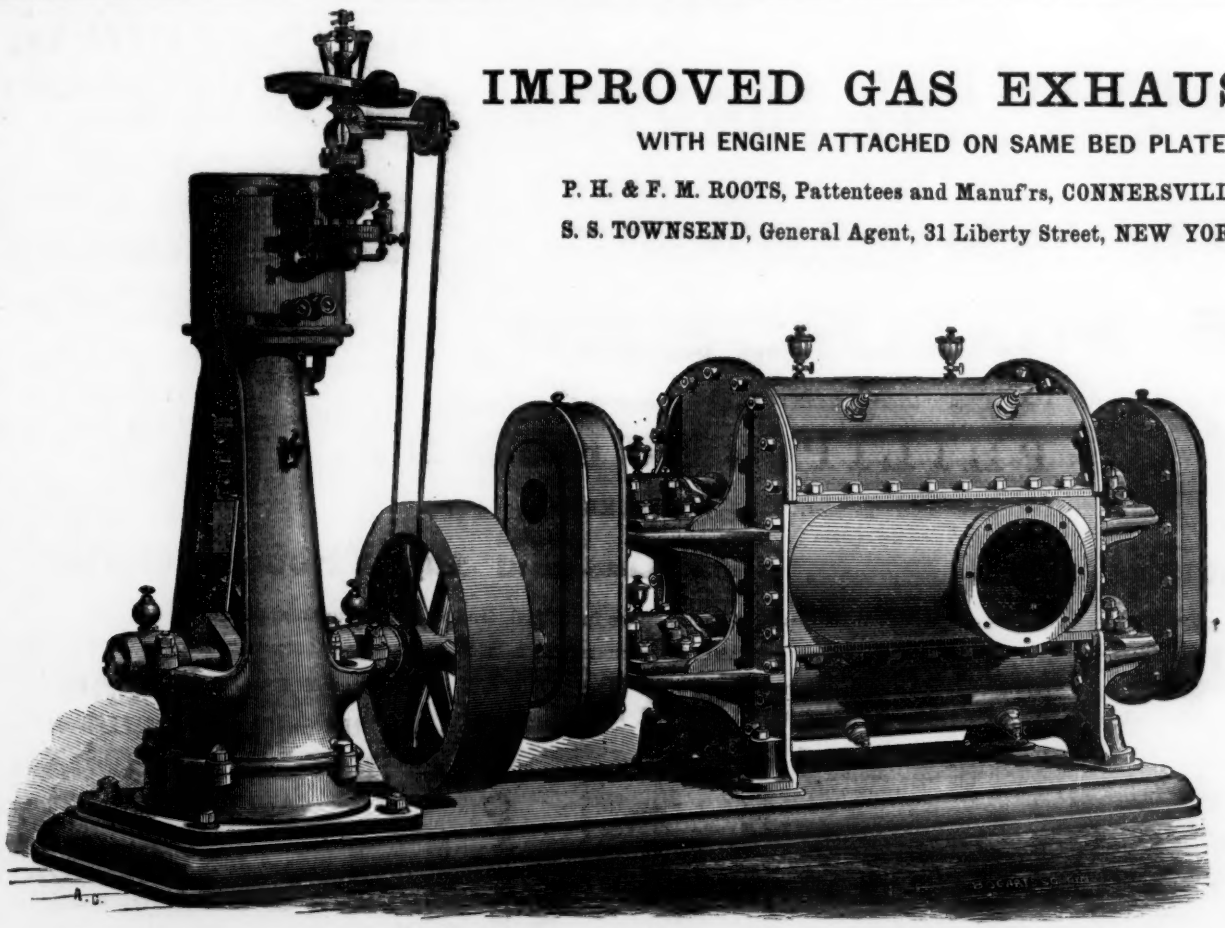

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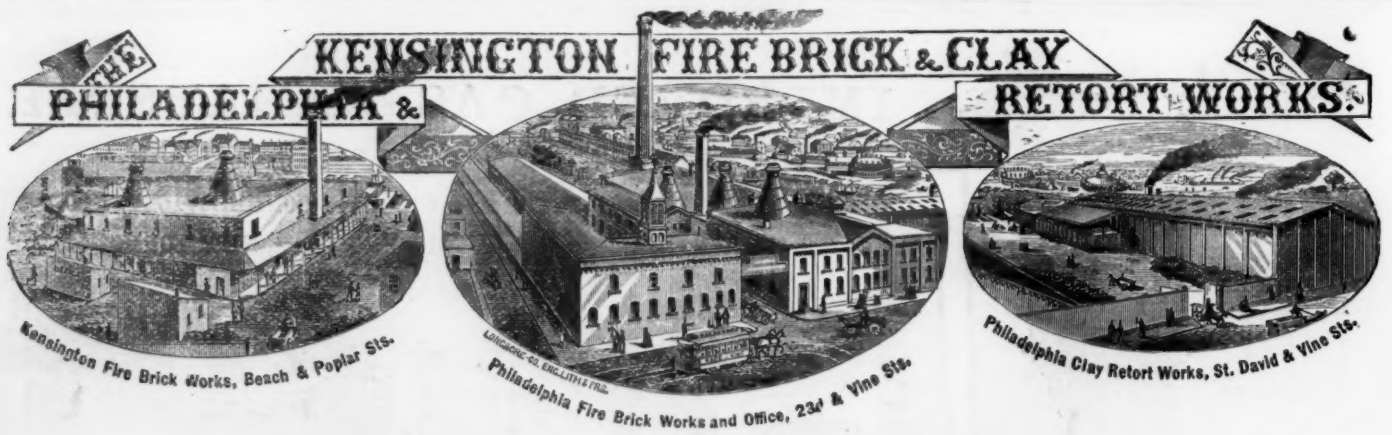
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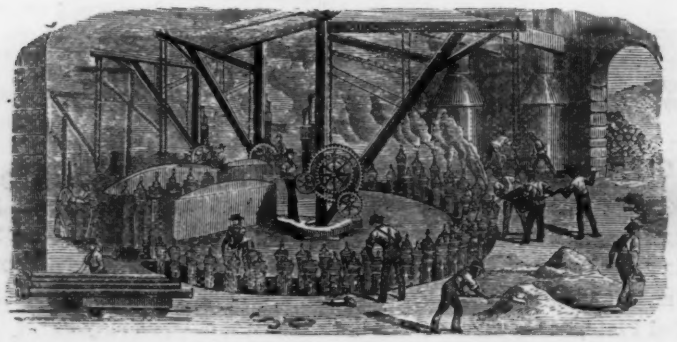

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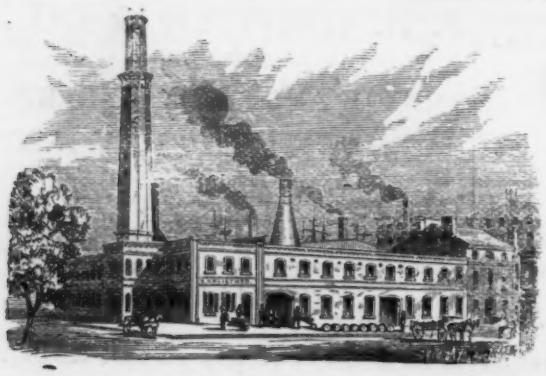

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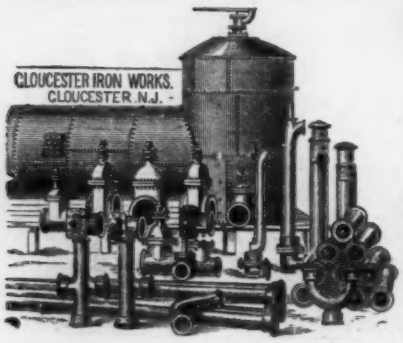

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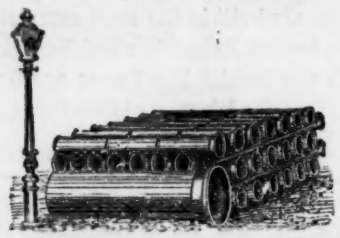

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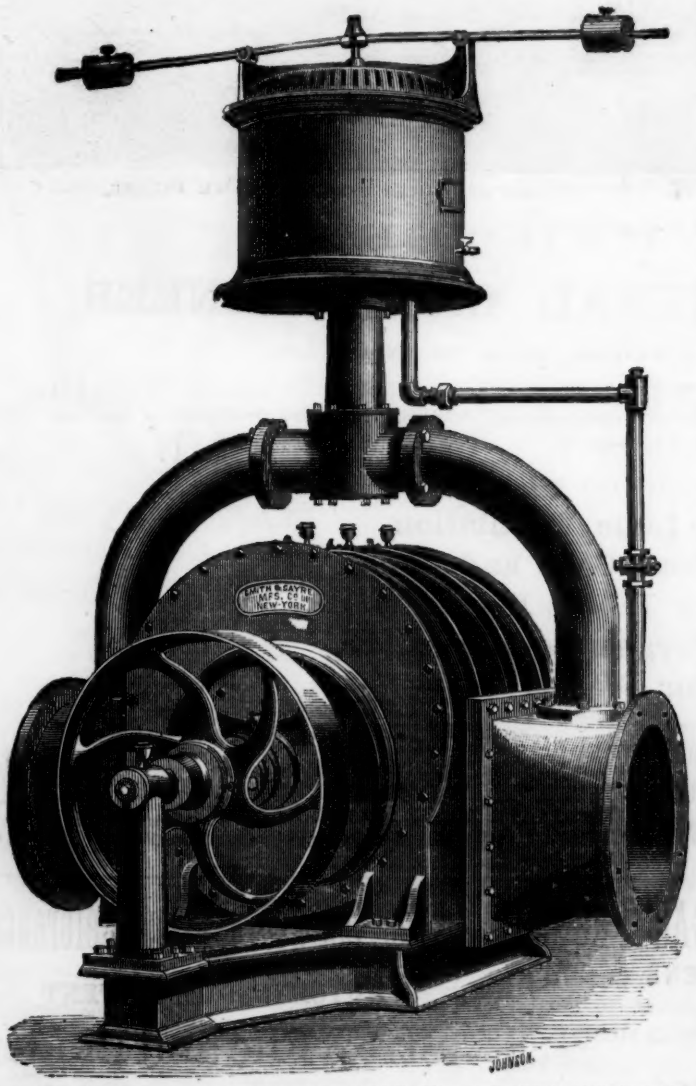

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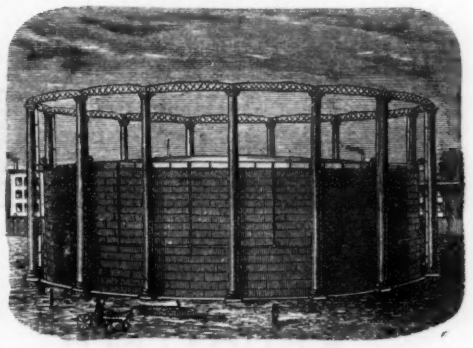

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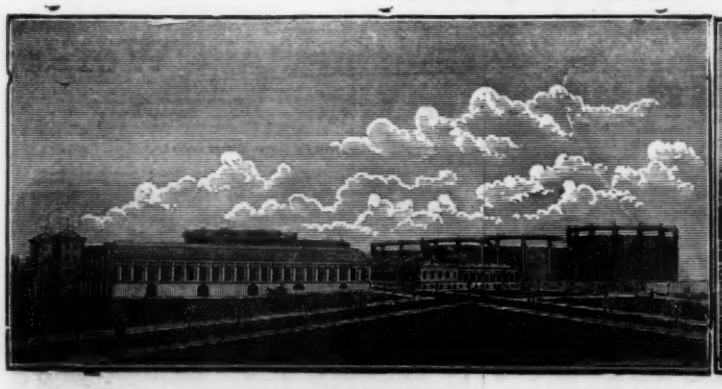

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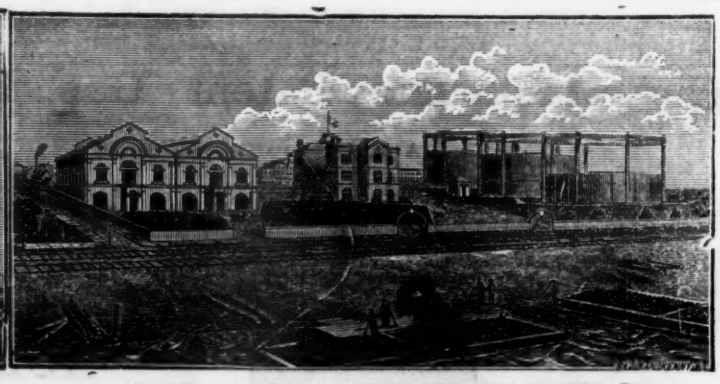

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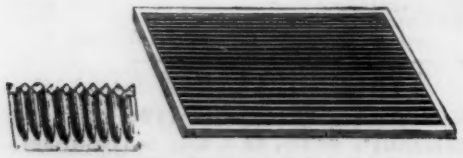

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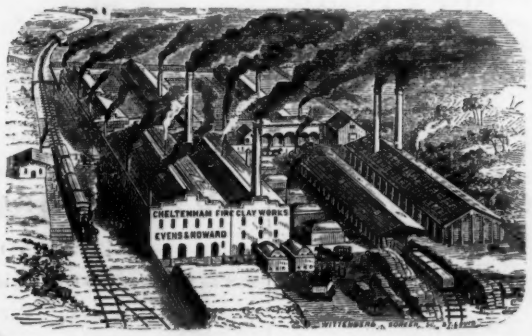

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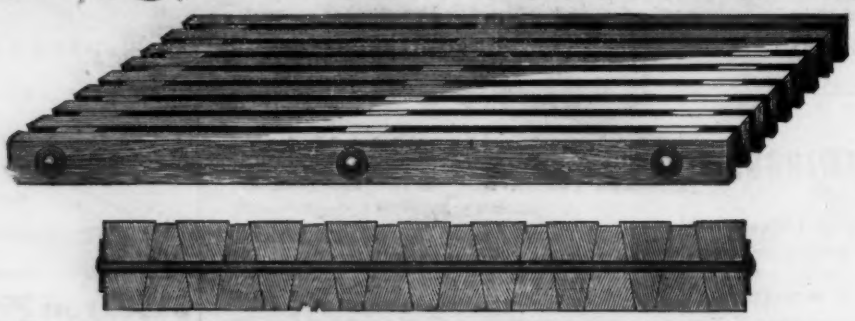

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